

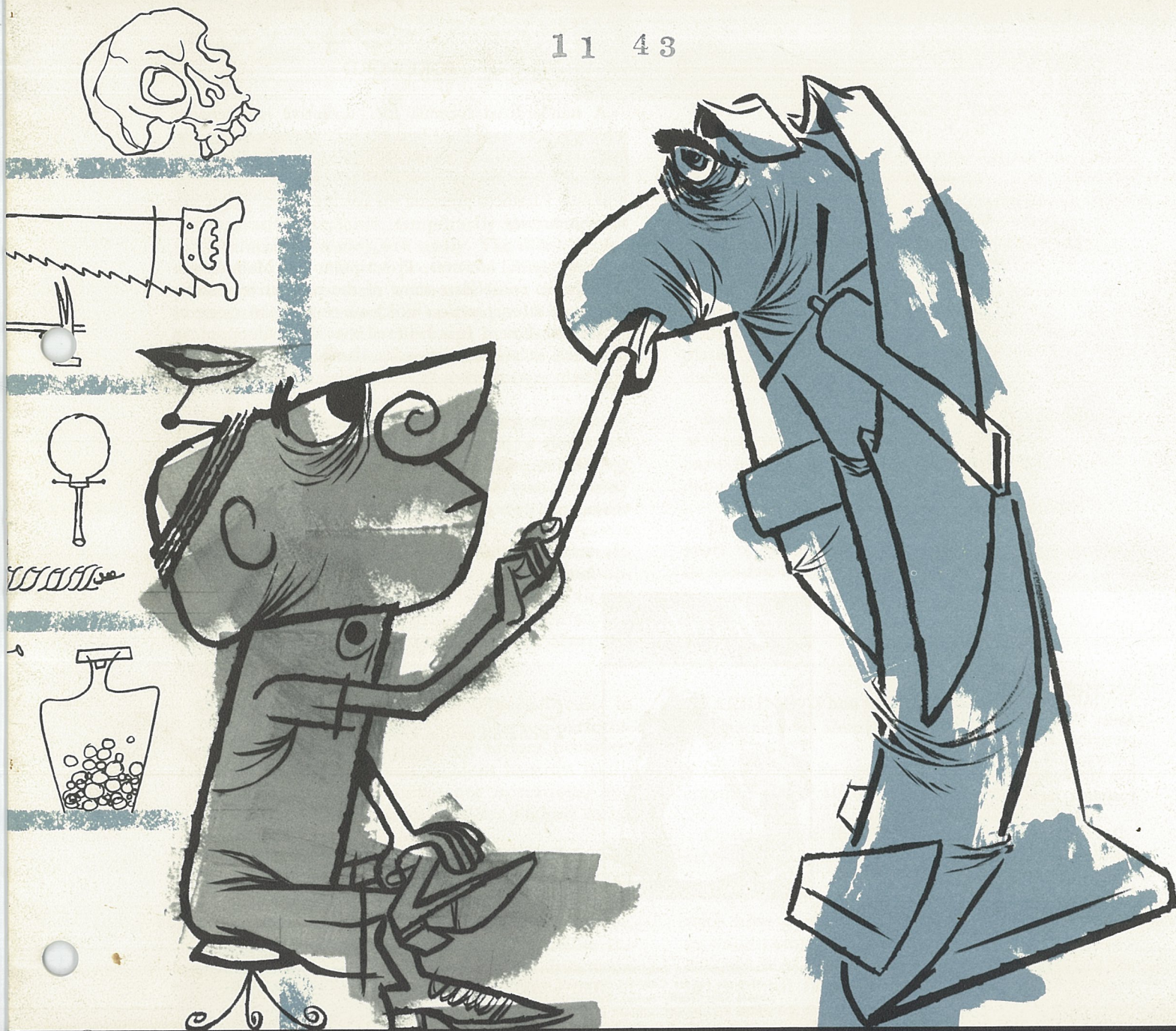
CONVAIR *Traveler*

VOLUME IX

NUMBER 4

SEPTEMBER 1957

11 43



RX

FOR MAINTENANCE

CONVAIR *Traveler*

VOLUME IX

NUMBER 4

SEPTEMBER 1957

Chief Engineer
R. L. Bayless
Manager of Service
J. J. Alkazin

Chief Service Publications
H. R. Kennedy
*Chief Service Engineering—
Transport*
L. J. Bordelon

Editor
G. S. Hunter
Writer
Van Hedges
Art Editor
N. J. Rutherford

FOREWORD

A standardized formula for preventive maintenance which guarantees long life and safe operation to an aircraft is no easy thing to come by. Differences in flight and weather conditions, geographical dissimilarities, and operational variances preclude the cutting of any magic key to maintenance.

This month, however, Prescription for Maintenance attempts to consolidate some of the preventive maintenance and safety practices which are common to operators of Convair-Liners. It is believed that their adoption can do much to prevent expensive damage to aircraft, and will help to keep them in a safe flying condition.

In the August issue, safe maintenance procedures as they apply to personal safety are discussed. Prescription for Maintenance, while also taking cognizance of the personal safety factor, emphasizes preventive maintenance measures which will protect the airplane itself.

ON THE COVER

Artist Willis Goldsmith's M.D. prescribes P.M. for his feverish patient. P.M. stands for Preventive Maintenance, available at all customer facilities.

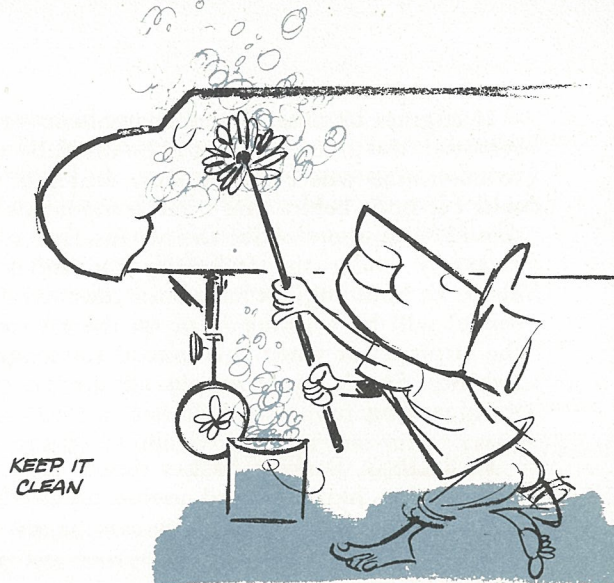
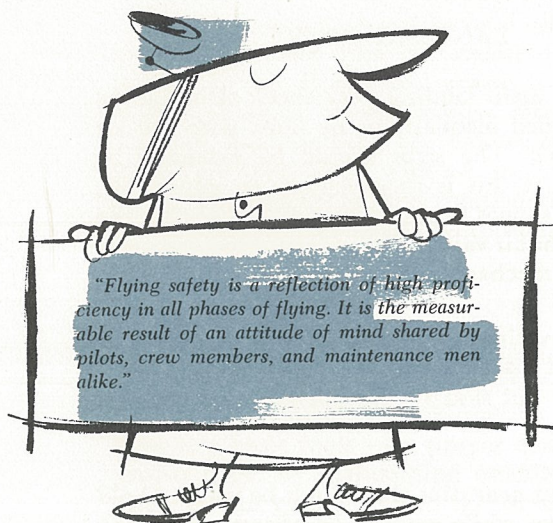


Copyright 1957

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of Convair-Liner operation and service published monthly by the Service Publications Section of Convair in the interest of Convair-Liner operators. Communications should be addressed to Manager of Service, Convair, San Diego 12, Calif.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without specific approval of their cognizant organization.



R_x FOR MAINTENANCE

Inoperative airplanes, temporarily out of service for mechanical reasons, are costly. The often-quoted truth about an ounce of prevention being worth a pound of cure becomes more and more significant if the article in question, like an airplane, is an article of high value. Periodic check-ups by qualified specialists are the preventive measures which can spell the difference between operational and out of service.

Maintaining an airplane in safe flying condition is primarily an everyday task of keeping a multitude of small items in first-class condition, and preventing minor troubles from becoming major ones. Delivery of more than 1000 Convair 240's, 340's, and 440's throughout the world has provided a composite guide for the proper maintenance of these aircraft. The experiences and suggestions of the original operator and subsequent operators have resulted in certain general maintenance procedures which should prove of value to all present-day Convair-Liner operators.

Cleanliness is one of the most important rules in helping to keep an airplane in proper, top-performing condition. A clean, sparkling surface promotes good will, reduces fire and accident hazards, facilitates inspection and maintenance operations, and helps the operator to maintain fullest payload carrying capacity.

Regular replenishment of the aircraft's fuel system, ADI tank, oil servicing tank, hydraulic reservoir, batteries, fire extinguishers, and other systems, in the correct amounts and mixtures, provides the nutrition to motivate these correlated functions, and activates the aircraft as a competitive unit in today's commercial aviation field.

Carefully conducted, periodic inspections guarantee the continued well-being of the airplane, by alerting the maintenance crew to parts replacement needs and structural repairs before any possible chronic condition can develop.

During maintenance operations, it is always good practice to keep all areas clear of debris. This requirement is especially desirable within the airplane, where such debris might become lodged in the working systems and be the cause of an accident.

Before locking up the airplane, after completion of a job, it is always advisable to make sure no tools have been left in the airplane which could cause damage.

The following procedures are a compilation of years of experience and practice which have made day-to-day aircraft operation a safe one.

GROUND HANDLING

JACKING. When jacking the airplane, the following restrictions should be observed.

Gear should be operated only when the jacks are engaged under all three jacking points.

Operation of the steering mechanism while the airplane is on jacks may damage the centering cams.

With any normal center of gravity condition, or with nose gear and engines removed and airplane in weight empty condition (10.6% MAC for 340 and 440, 6% MAC for 240), the nose may be lifted to any height until the tail touches ground with the airplane resting on the main gear.

If engines or other heavy components are to be removed, the procedure should be carefully planned to determine where the airplane center of gravity will be, both before and after components are removed. A support under the aft fuselage section is necessary under the following conditions: when either or both engines have been removed and personnel will be working in or on the aft section of the airplane; or when it is needed for longitudinal stability. Shock struts should not be extended to speed jacking.

PARKING. Parking brakes should never be set after brakes have received undue use in landing. When brakes have cooled, they may be set without subsequent seizing.

TAXIING. Sharp turns should be avoided when taxiing at high speeds in order to prevent damage to the nose gear and to prevent excessive wear on tires. The use of brakes or asymmetrical thrust in taxiing should not be practiced unless the procedure is necessitated by failure of the nose wheel steering system.

TIE-DOWN. When strong winds prevail, it is important that the airplane be tied down facing into the wind.

TOWING. The airplane should not be towed with the nose wheel scissors connected. With the scissors connected, minimum turning radius of the airplane is 27 feet; by disconnecting the scissors, it is possible to pivot the wheel 360° for towing. To rotate the airplane 360°, a minimum clearance of 125 feet in diameter is required in order to clear the wing tips.

After towing, the nose wheel scissors pin should be reinstalled all the way through both ends, and safetied.

LANDING GEAR

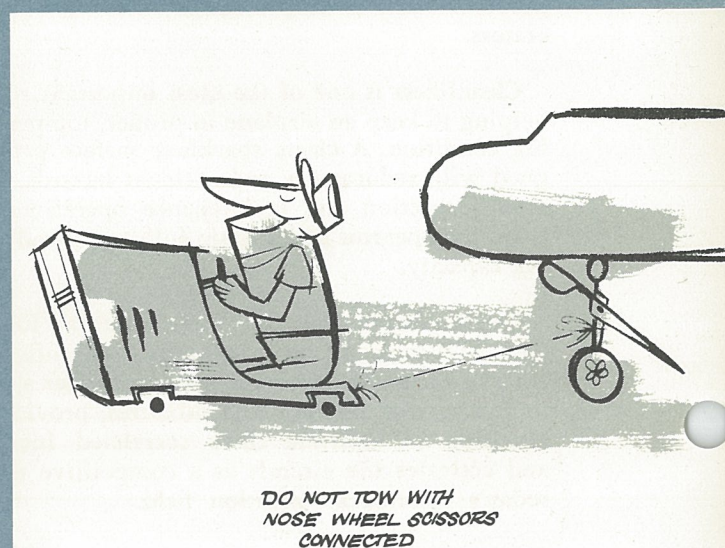
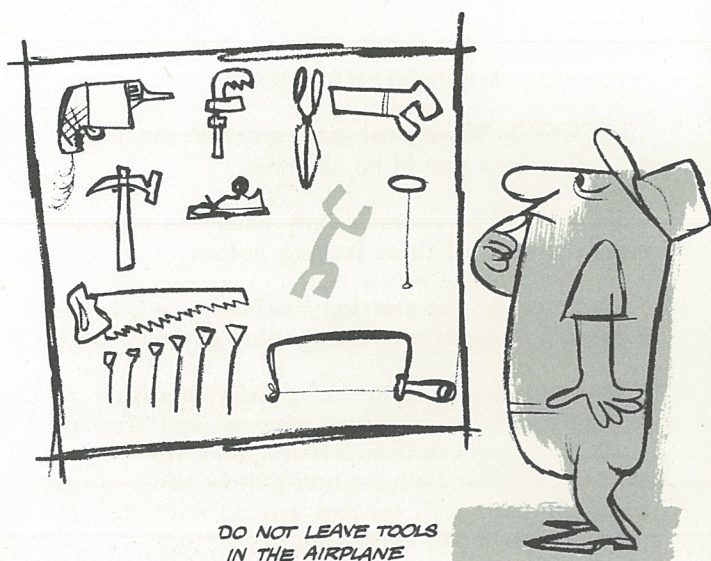
An empty main landing gear shock strut should not be extended manually or by hoist with the air valve installed. The strut should be extended by air pressure. If this is inconvenient or impossible, the air valve should be removed, a clean lint-free rag placed over the air valve hole, and the extension made manually or mechanically.

During servicing of main and nose landing gears, a jack may be used for balancing fuselage at the tail skid, but the tail skid should not be used as a jack point.

The landing gear pins should not be used to hold one gear down while making an operational check on the other gear. Lock linkage of the actuating cylinder on the gear not to be operated should be disconnected.

The hydraulic bypass valve should be put in the UP position (when not operating the gear) because, if the landing gear lever is inadvertently operated when the bypass valve is in DOWN position, injury to personnel and damage to the aircraft may result.

When installing a new landing gear actuating cylinder, the cylinder should be hydraulically cycled a minimum of five times (with the cylinder installed) before connecting the actuating cylinder to the gear. This will remove any air in the UP line to the cylinder and in the UP side of the cylinder. Air trapped in the cylinder will give too rapid an extension of the gear, causing a sudden jolt when the actuating cylinder pushes all the air out of the lines and hits a solid column of hydraulic fluid. This condition could cause the airplane to be thrown from the jacks.



Special attention should be paid when inspecting landing gear and tires. Structural defects may be hidden unless all dirt and grease have been thoroughly removed. Most products recommended for cleaning landing gear are emulsion-type cleaners which are sprayed on with air and rinsed off with water. The solvents in these compounds are injurious to rubber, and tires should be thoroughly rinsed off with water.

TIRES. The maintenance of proper air pressure in tires is an absolute essential. Before any mechanic can properly inflate a high-pressure tire, he must have two basic tools — a proper compressor and a proper gage. By maintaining established tire pressures, he can greatly extend the service life of each tire. This necessitates checking tires at least once a week, and checking newly-mounted tires every day for several days, after which a regular inflation schedule may be followed.

If either or both of the inboard main landing gear tires show undue wear as a result of runway crown, it is advisable to decrease the pressure in these tires by 5 psi in order to reduce and equalize wear.

Over-inflation, to offset overloading, is not recommended because increased tension and strain on the tire cords may not provide sufficient stretch to absorb landing shocks. Tread and sidewall rubber under tension makes tires more susceptible to cuts, and increases the tendency to enlarge existing cuts.

Tires that are under-inflated are prone to creep or slip on the wheels when landing or when brakes are applied, and there is a possibility that the sidewalls will be pinched by the rim. Under-inflation will also cause uneven wear along the edge or near the edge of the tire.

Casings and tubes should be stored in a clean, dry place, out of the sunlight and away from electrical equipment such as motors, generators, and battery chargers. Ozone deteriorates rubber. Stored casings or tires and wheel assemblies should be rotated to prevent flat spots. Tubes removed from casings and held for storage should contain sufficient air to hold them in shape.

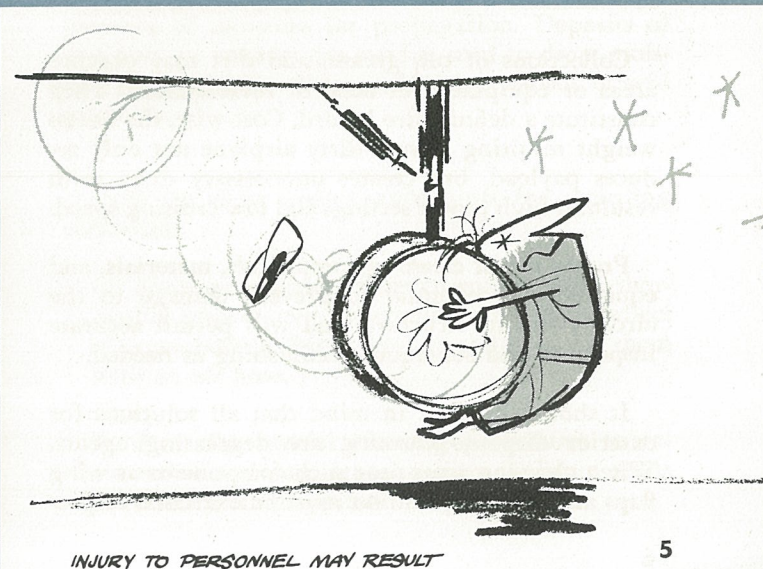
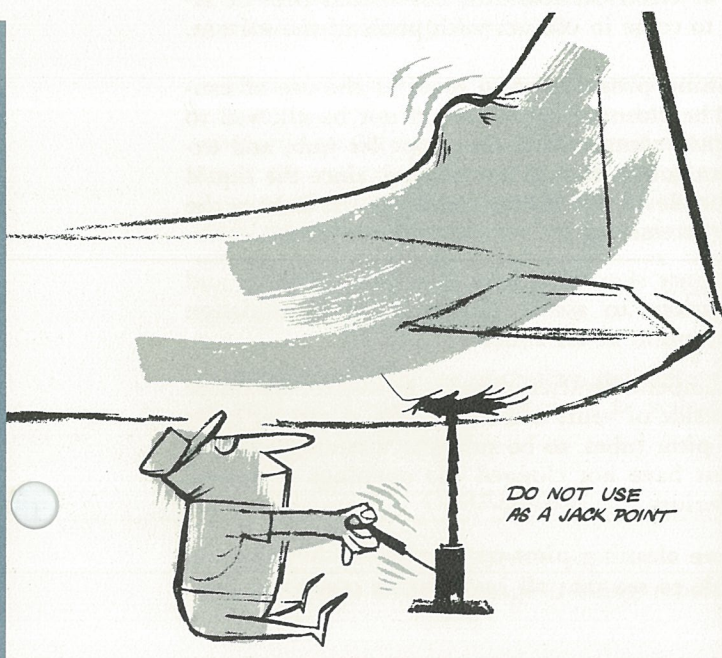
If large cuts, blisters, or breaks appear in the casing, the casing should be removed and tagged. A blister can be serious in an otherwise sound casing. If a blister that is wider than two inches across is found in the sidewall area, it should be marked with a wax pencil before the tire is deflated and removed. Blisters less than two inches across may be punctured with an awl.

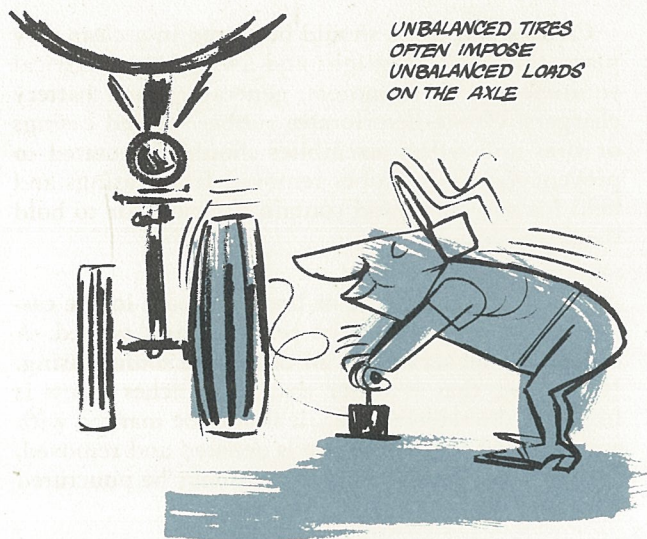
Careful inspection of areas and runways should be made regularly and all foreign objects picked up that might cause tire damage. Since oil deteriorates both natural and synthetic rubber, surfaces of ramps, runways, and floors should be kept oil-free.

Unbalanced nose landing gear tires often impose unbalanced loads on the axle and bearings and cause vibrational yawing in steering. Mismatched tires on dual wheels affect braking action, causing drag.

An attempt to match tires having the same degree of wear should always be made. A new tire should never be mounted opposite one on which tread has been worn.

Maintenance men have learned that excessive heat on a tire often may be detected by the appearance of the inner tube or the casing beads when the tire is taken off the wheel.





Rubber that has been exposed for a prolonged period of time to moderately high temperatures will be brittle and cracked. On the other hand, a soft, tacky condition is the symptom of reverted rubber, resulting from short exposure to extremely high temperature.

After any emergency stop (especially if brakes are used hard and excess heat is noticed), the tires should be dismounted, and the tubes and casings inspected carefully. Similarly, it is important that maintenance personnel inspect casings and tubes for excessive heat signs whenever routine tire changes are made. The ramifications of the findings after such inspections may be far-reaching.

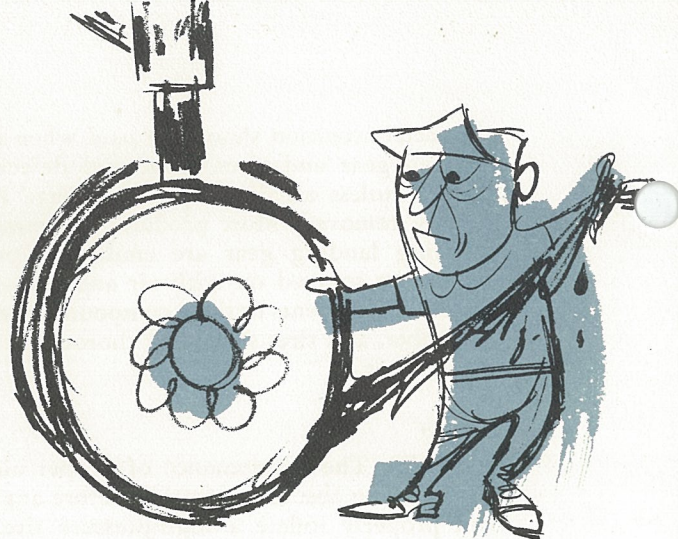
CLEANING

Because an airplane flies through all kinds of weather, over land and water, it collects deposits of oil, grease, dirt, and corrosive materials. These deposits can be damaging, not necessarily in themselves, but as the cause of more serious trouble in the future.

Collections of oil, grease, and dirt may obscure areas or equipment in need of maintenance. They constitute a definite fire hazard. Cost-wise, the excess weight resulting from a dirty airplane not only reduces payload, but creates unnecessary drag, with resultant high power settings and low cruising speed.

Proper use of cleaning compounds, materials, and equipment is essential to prevent damage to the aircraft and its structure, and will permit accurate inspection and subsequent refinishing as needed.

It should be kept in mind that all solutions for exterior airplane cleaning are degreasing agents. When cleaning areas near such components as wing flaps and controls, caution must be exercised to pre-



vent solutions from coming in contact with bearings, thereby reducing the lubricating effectiveness of the grease. After the airplane has been washed, dry air should be blown on dust seals or bearings, so that drops of cleaner cannot seep through bearing seal edges by capillary action.

Careful application is required of compounds used for removal of oil, grease, and surface dirt from wheel wells and nacelles. These compounds are mixed with petroleum solvents to emulsify the oil, grease, and dirt, and the emulsion is then removed by rinsing or by spraying with a petroleum solvent. Application of a film of hydraulic oil to the landing gear actuating cylinder rods, after cleaning, will prevent damaging the "O" ring in the cylinder bearing. When a water rinse is used, all water should be removed by blowing it out with an air gun, since any that remains may freeze and lock the controls. Such solvents should not be sprayed on distributors, magnetos, or electrical conduits, nor should tires be allowed to come in contact with pools of the solvent.

Cleaning propellers also requires the use of caution. The cleaning agent should not be allowed to come into contact with the propeller hub, and excessive amounts should not be used, since the liquid may run down the blades and enter the hub or the engine accessories.

Antennas should be kept free from deposits and incrustations to assure proper radio transmission and reception at all times.

It is imperative after cleaning to inspect the inside and outside of vents and holes, such as the air holes in the pitot tubes, to be sure that cleaning solvents and lint have not clogged the openings or fouled the interiors.

Before cleaning pitot-static tubes, a check should be made to see that all instruments operating from



the tubes are disconnected and that tubes are moved to a position not in line with the instruments. When testing static lines, pressure should not be applied to them, since injury to instruments may result.

Toxic cleaning materials should not be used for washing the wing in the area of the ram air scoop. Clogging of the drain line may permit the fluid to remain in the duct, with consequent ill effects on passengers and crew.

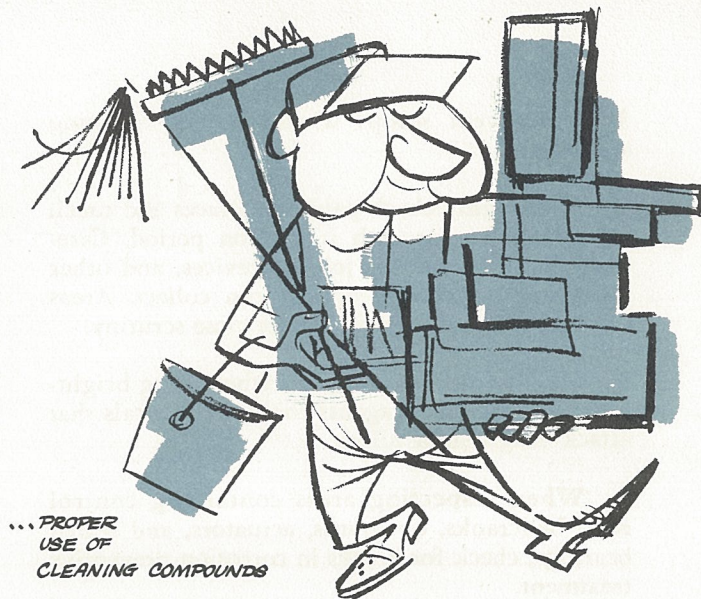
The exterior surface of cabin windows is plate glass, and any reliable spray, or soap and water, is suitable for cleaning them. The interior surface of the window is plastic, and as such requires special care in cleaning. Most spray cleaners contain chemicals that have a diluent action, and hence are injurious to plastics. When cleaning interior windows, care should be taken not to rub hard particles into the surface. Abrasive compounds or coarse, soiled mops should never be used to clean windows, since serious scratches or marring may result.

Electrical equipment requires careful cleaning if it is to function efficiently. Carbon dust and other conducting soils may cause flashovers if not removed from the motor. Lubricating oils and grease may damage delicate insulating materials. Cleaning solutions which are effective on heavy engine parts are seldom suitable for electrical equipment, since their use may strip insulating varnish and cause serious damage to sensitive parts.

During any cleaning operation, detection of items in need of inspection, adjustment, or repair of any sort should be reported.

CORROSION

Corrosion weakens aircraft structures, results in loss of service while damage is being repaired, and



means an expenditure of money and man-hours for repair. In addition, the aircraft's unsightly appearance indicates lack of an effective maintenance program. When corrosion is discovered, it should be removed completely at the earliest opportunity.

All corrosion starts on the surface, where the metal is exposed to the corrosive environment. It destroys metals by chemical action through direct chemical attack (acid on metal), or by electrochemical action, which occurs between two different metals in the presence of moisture.

Surface evidence of corrosion is revealed by uniform etch, or a general dulling of the surface from chemical attack. This progresses to roughening and/or frosting of the surface. Pitting is the most common effect on aluminum and magnesium. It first appears as a white or grey powdery deposit. Exfoliation is visible evidence of intergranular corrosion, with the surface of the metal lifting or peeling.

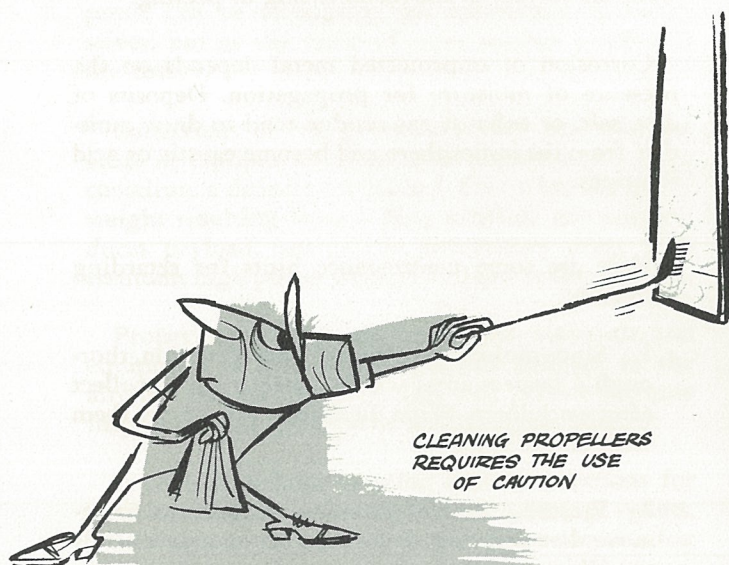
Corrosion of unprotected metal depends on the presence of moisture for propagation. Deposits of dirt, salt, or exhaust gas residue tend to draw moisture from the atmosphere and become caustic or acid solutions.

Here are some maintenance hints for retarding corrosion:

1. Since moisture energizes corrosive action, thoroughly inspect areas where water is apt to collect after washdown. Wipe these areas dry, or dry them with an air hose.
2. Prescribe careful cleaning procedures to remove dirt and dust deposits, since moisture tends to collect at these points.

3. Cover vent scoops when airplane is being washed.
4. Thoroughly check painted surfaces and touch up as required at each inspection period. Carefully check seams, lap joints, crevices, and other areas where moisture or dirt can collect. Areas exposed to exhaust gases require close scrutiny.
5. Mask off magnesium parts when using brightening agents. These agents contain chemicals that attack magnesium alloys.
6. When inspecting areas containing control rods, bellcranks, quadrants, actuators, and sealed bearings, check for breaks in corrosion-preventive treatment.
7. Do not apply corrosion preventives over corrosion products.
8. Corrosion may attack metal even though it is painted because, after prolonged exposure, moisture can penetrate the paint.
9. If battery acids are spilled, wash the area immediately with a dilute solution of sodium bicarbonate in water. After allowing it to dry, remove all traces by thoroughly rinsing with water.
10. Thoroughly inspect all plated bolts before re-installation. Scored bolts should not be reinstalled.
11. When sealing faying surfaces, be sure a small fillet of the sealant is exposed at the edge of the faying surfaces. When sealing butt joints, be sure the space provided between the joints is sealed.

When rust is noticed around the rim of a landing gear wheel, the tire should be removed and the metal buffed clean. Oil or grease should never be used on the metal rim.



The depth and length of a scratch and the vibration cycles imposed will determine the life of a particular section of metal. The deeper the scratch or partial rupture, the greater the reduction of fatigue resistance. If a scratch is left unattended, operating stresses will eventually elongate and deepen it.

Only certain areas and portions of the airplane are designated to be used as walkways, supports, or handholds. Control surfaces are not constructed as walkways, nor are the wing areas outside the spar line. Soft-soled shoes should be worn if it becomes necessary to walk on the wing in the spar areas.

All work stands should be properly padded, since any scratch caused by contact of the stand with metal is a potential crack.

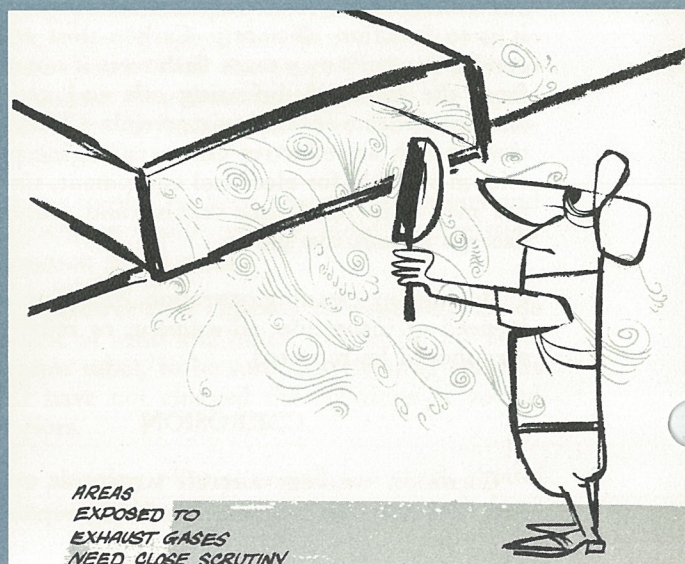
POWER PLANT

When removing a carburetor from an engine, a cover should be installed on the mounting pad and all open tubes should be capped.

Heavy loads should never be placed on the cowl panel, nor should it be dropped or swung open violently.

Precautions against fire should be taken when removing engine fluid shut-off valves. Fluid remaining in lines will escape when valves are disconnected. The airplane and all draining equipment should be electrically grounded, and a portable fire extinguisher placed in the working area.

Fire extinguishers should be recharged after use, and should be inspected periodically for weight loss. In purging the fire extinguisher system after CB containers have been discharged, the exposed areas should be dried carefully and as soon as possible. CB



is highly corrosive to aluminum and magnesium, especially in the liquid state. Extinguishers should be kept in effective operating condition by checking their replenishment dates at regular intervals.

In checking fire detection systems, replacement of any relays in the primary relay panel or in control assemblies should not be attempted. The whole unit should be replaced. An open flame should never be used when testing thermocouples or detector loops, and extreme care must be taken when replacing thermocouples to see that the "plus" terminals of any two adjacent thermocouples in the same loop are NOT wired together.

When propeller operation is checked with the engine inoperative, oil is discharged into the engine sump. The engine sump drain plug should either be removed before checking the propeller, or the engine sump should be drained after the check is completed.

After propeller checking, the propeller should be turned over by hand before starting the engine. In order to prevent overheating, the propeller feather pump should be operated one minute only at 15-minute intervals.

During ground feathering checks of the left-hand propeller, power setting should not exceed 45 inches MAP (throttle approximately two-thirds open) to preclude inadvertent disengagement of the cabin compressor.

During cold weather operation, the propeller should be cycled several times to insure hot oil in the propeller dome. No amount of ice should be allowed to remain on the propeller under any circumstances. The accumulations during ground operation may break away and damage the fuselage forward of the ice protection shields.

The propeller control should be kept in low pitch whenever the airplane is on the ground, in order to avoid cowl damage.

SERVICING

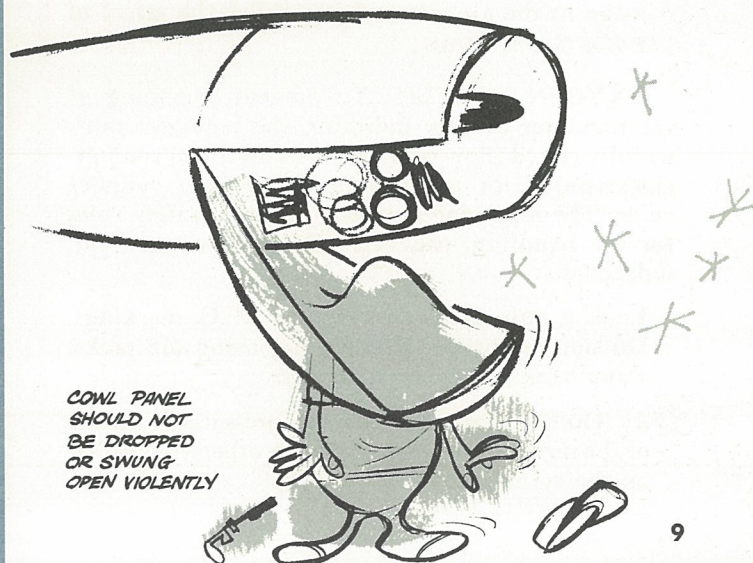
FUEL SYSTEM. At least two references should be used to determine the amount of fuel on board. It is well to remember that the tank truck flowmeter indicates only the amount of fuel added — not the total amount on board. Boston sight gages on lower surface of wing are used only as a check during fueling; fuel quantity gages in cockpit indicate the quantity of fuel in pounds, which, due to varying density of gasoline, is a more accurate measurement.

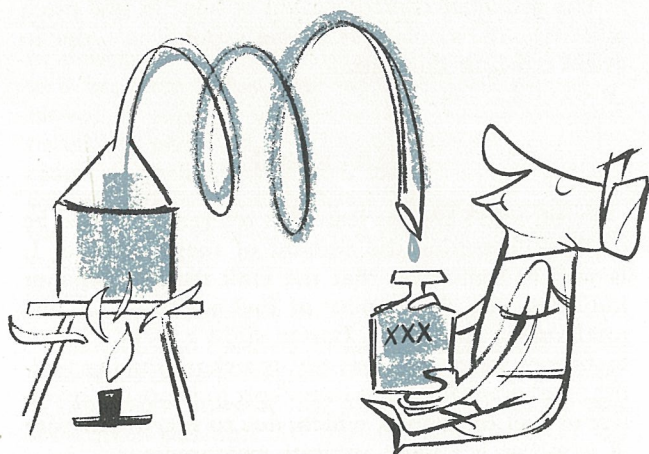
Transfer of fuel from one tank to another should not be attempted, since the action may result in overflow of fuel from the vent. The system is not designed for transfer from tank to tank, and such procedures are prohibited by CAA.

Tanks should not be filled at night with cold fuel. The heat of the day will cause the fuel to expand, and flow through the vent.

During cleaning and resealing operations, tanks should be well-ventilated with a constant supply of fresh air.

HYDRAULIC FLUID. Before filling any hydraulic system, the type of fluid used in that system should be determined. Care must be exercised not to use fluids not placarded for a system, and also that fluids are not mixed in a system. Mineral base fluids, such as AC3580, MIL-O-5606, and Shell 1AC should not be mixed with Skydrol, and Skydrol should not be used in equipment unless the equipment is placarded for its use.





... ONLY DISTILLED WATER SHOULD BE USED

OIL TANKS. During winter operation, when it is necessary to service the oil tanks, it should be done prior to dilution and in accordance with the CAA-Approved Flight Manual.

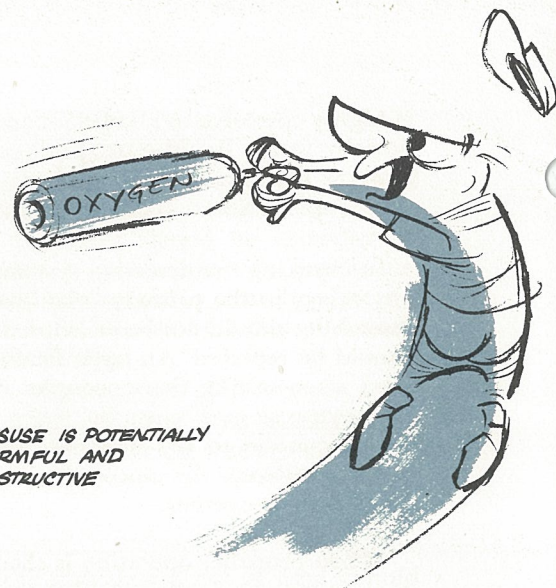
ADI MIXTURES. It is extremely important to make sure that the ADI mixture is from the correct drum when servicing the ground ADI carts. The use of a foreign liquid can spell disaster.

Only distilled water should be used in the water-alcohol mixture. The solution should be agitated in order that it may be thoroughly mixed, after which it should be filtered through a 10-micron filter before being used in the airplane. Only by thorough agitation will the mixture give the desired results and preclude the possibility of freezing.

The ADI liquid itself should first be suspected as the cause in cases of corrosion or disintegration of the system components. Solution containers should meet required standards, with the contents clearly marked to eliminate the possibility of servicing the aircraft with a solution that could conceivably cause damage to the aircraft and jeopardize the safety of passengers and crews.

OXYGEN BOTTLES. To prevent damaging of the regulator or flow indicator, the regulator must be fully closed (flow control knob full travel counterclockwise) prior to opening the oxygen cylinder valve. The following are some pertinent safety rules for the handling, use, and storage of oxygen cylinders.

1. Use only cylinders carrying I.C.C. markings. Do not improvise cylinders by using air tanks, water tanks, or other containers.
2. Do not charge cylinders to pressures in excess of the service pressure stamped or otherwise shown on the cylinders.

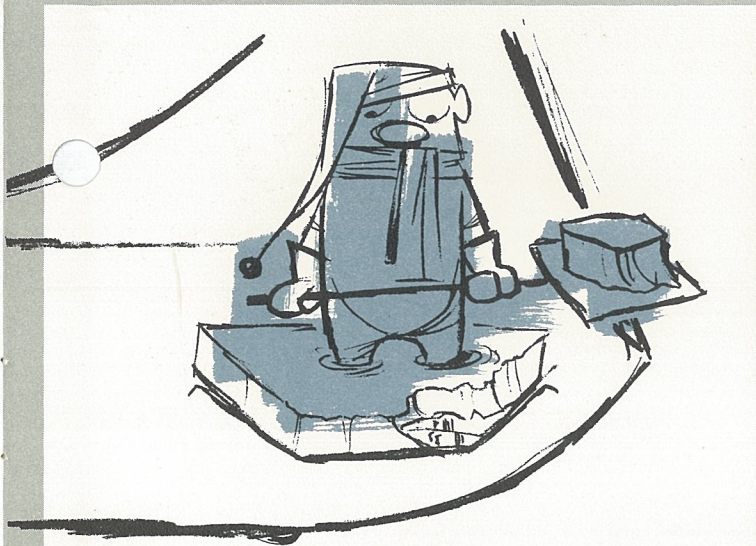


MISUSE IS POTENTIALLY
HARMFUL AND
DESTRUCTIVE

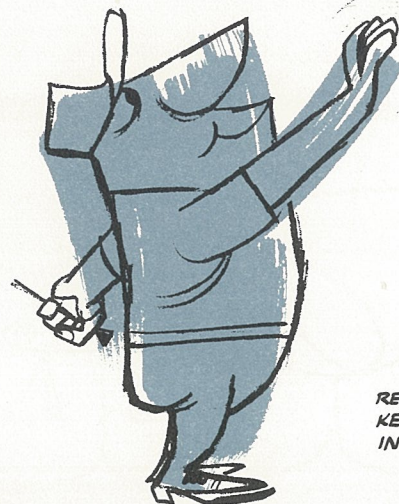
3. Do not tamper with cylinders. Do not attempt to repair valves unless cylinder is empty, and the operator is equipped for and experienced at such repairs. Do not weld, braze, or solder leaking, cracked, or dented cylinders. Do not use cylinders which have been exposed to fire.
4. Store cylinders in a cool, dry place. Position cylinders to prevent them from falling.
5. When handling cylinders, do not knock them over or permit them to fall. Do not use the valve cover-cap as a handle for carrying or hoisting.
6. Do not abuse cylinders by using them as rollers, anvils, etc.
7. Keep cylinder valves closed when not in use, or when cylinder is empty. Be sure cylinder valve connection is clean before attaching regulator.
8. Do not use oil, grease, or paint on cylinder valves, regulators, or connections. Do not handle valves, regulators, or connections with oily hands, gloves, or rags.
9. Do not use oxygen as a substitute for compressed air. Oxygen is extremely dangerous in many uses where air is perfectly safe.
10. Always treat oxygen with respect. Properly employed it can be useful and beneficial, but used improperly it is potentially harmful and destructive.

OPERATIONAL CHECKS

Periodic checks should be made to ensure that all communications equipment is in top operating condition. When using communications, conversations should be kept brief in order not to block emergency traffic.



PREVENTION IS EASIER THAN REMOVAL



*RECOMMENDED FOR
KEEPING CONVAIR-LINERS
IN TOP-FLIGHT CONDITION*

Pitot heaters may be checked before takeoff by turning the heater on and noting a drop on the load-meter. They should not be left on for more than 30 seconds during ground operations, or the element may burn out.

When making operational tests on windshields, the temperature of windshield panels should not be lowered with dry ice or by any other means that will suddenly cool them. The temperature should be lowered gradually to avoid cracking the glass.

Wipers should never be operated when windshields are dry, because of possible scratching of the surface.

Augmentor vanes should not be left in the CLOSED position when checking with the engines running on the ground. Insufficient air flow causes overheating which could result in structural damage to the augmentors.

COLD WEATHER OPERATION

The flight characteristics of an airplane carrying snow or ice are similar to those of an overloaded airplane. The responsibilities of the person or persons concerned with the prevention or removal of snow, frost, or ice deposits should be clearly defined and known by all concerned, so that decisions can be made and action taken to prevent or eliminate deposits in sufficient time to avoid delay or cancellations of a scheduled flight. Properly planned prevention is always easier than removal.

To eliminate freezing of controls during winter operation, all areas should be kept well-drained.

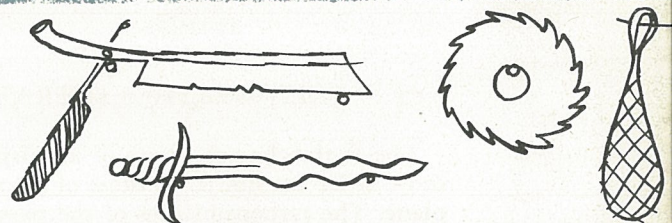
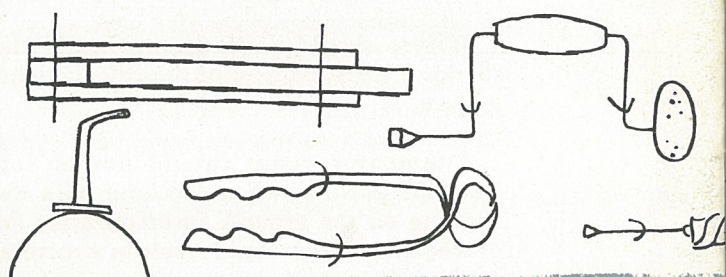
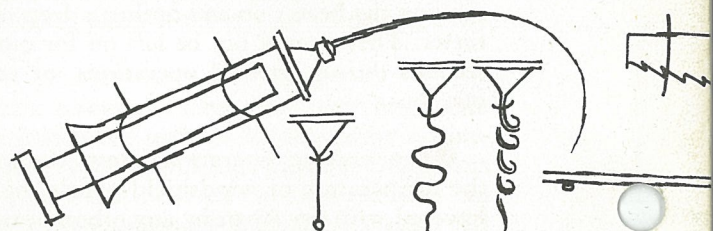
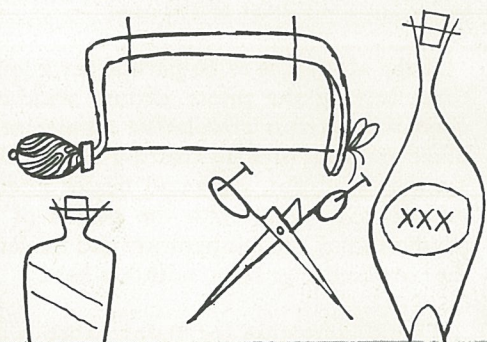
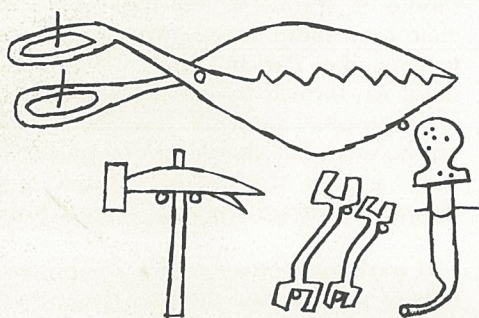
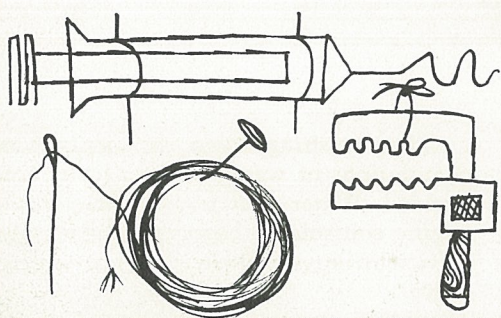
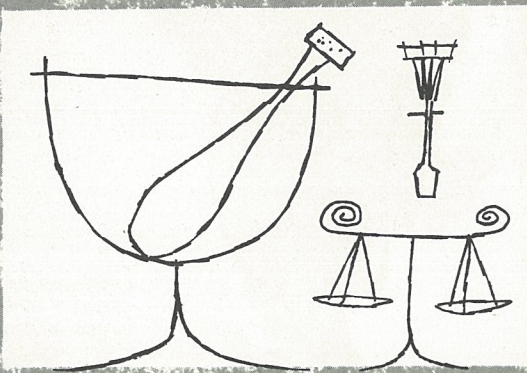
When washing down the airplane, excessive accumulations of water in the nacelle area should be avoided. Water that remains may freeze and lock engine controls. A light coating of oil on external service fittings is beneficial in preventing formations of ice.

Lavatory water tanks and drinking water bottles should be drained as required, as well as fuel sump, main tank sump drain, pitot-static lines, and rudder torque tube. Parking brakes should not be set because ice formed by condensation may freeze them in the applied position. Sand bags or wheel chocks can be used, but should not be placed in direct contact with the tires. If brakes freeze, they may be thawed and dried with the ground heater.

If parking is unavoidable in an area where there is snow and ice, and the tires freeze onto the surface, the airplane should not be moved until they are freed. This may be accomplished by using rock salt or by applying heat to the area.

If the aircraft is to be parked for a long period of time, leaving the pilots' sliding windows partially open will permit circulation of air inside the airplane and thus prevent frosting of windows. In preparation for flight, a ground heater attachment will preheat the cabin, with the period of heating dependent upon the temperature and the length of time the airplane has been without heat.

This prescription for maintenance is an open one which never needs refilling. The judicious use of its ingredients, consisting of the foregoing procedures combined with the personal safety measures listed in the August Traveler, is recommended for keeping Convair-Liners throughout the world in top-flight condition during their long and serviceable careers.



CONVAIR

Traveler

VOLUME IX

NUMBER 5

OCTOBER 1957

A composite illustration. The upper half features a detailed line drawing of a man's face, wearing glasses and a suit, looking slightly to the right. The lower half shows a Conquest II jet in flight, viewed from a low angle, with its four engines and wings clearly visible. The man's hand is shown holding the fuselage of the aircraft. The background is a textured, dark grey. At the bottom right, there is a stylized globe graphic consisting of several overlapping circles.

SUPPORT - AROUND THE WORLD

CONVAIR *Traveler*

VOLUME IX NUMBER 5 OCTOBER 1957

Chief Engineer
R. L. Bayless
Manager of Service
J. J. Alkazin

Chief Service Publications
H. R. Kennedy
*Chief Service Engineering—
Transport*
L. J. Bordelon

Editor
G. S. Hunter
Writer
Van Hedges
Art Editor
N. J. Rutherford

FOREWORD

A virtual "publications house" in its own right, Convair's Service Publications Section, operating within the Engineering Service Department, turns out the operations and maintenance manuals which support the Company's aircraft at operator facilities located in the United States and overseas.

In addition to producing the basic publications which will cover all service, maintenance, and operational phases of the new Convair "880," the world's fastest jet transport, this Section publishes other support material which helps to keep Convair customers currently informed on development and manufacturing progress of the Convair "880."

"Words to Go with Wings" tells the story of the Service Publications Section—its product and its people.

ON THE COVER

The man behind the Convair "880" in Artist Jack Davis' cover design is a composite of the writers, illustrators, catalogers, and production men whose written and visual support will help keep the new jet transport in top operational condition.



Copyright 1957

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of Convair-Liner operation and service published monthly by the Service Publications Section of Convair in the interest of Convair-Liner operators. Communications should be addressed to Manager of Service, Convair, San Diego 12, Calif.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without specific approval of their cognizant organization.



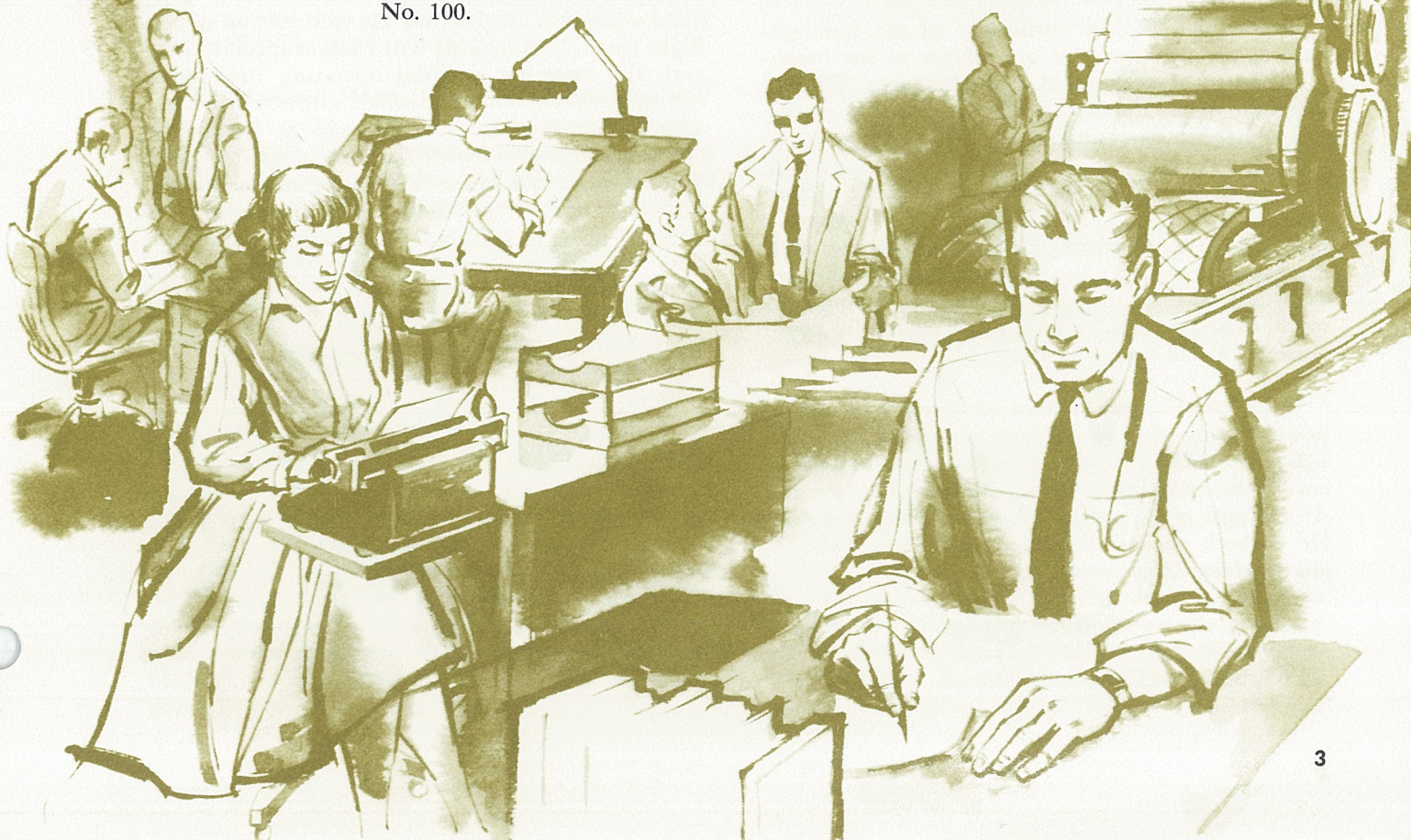
WORDS

to go with Wings

When the first of Convair's new "880" turbojet transports come off the production line in 1959, their delivery will be accompanied by several thousand pages of information vital to their future service, maintenance, and operation.

This information, some of which is already being compiled by Engineering Service Publications, will be contained in such volumes as the Flight Manual, Pilots' Handbook, Maintenance Manual, Overhaul Manual, Wiring Diagram Manual, Structural Repair Manual, and Illustrated Parts Catalog. In addition, such information will be incorporated in special training material, and will also appear in various other regularly and specially issued publications.

The basic Convair "880" publications plan calls for the preparation of one set of manuals, covering all versions of Convair "880" aircraft. These publications, with the exception of the CAA approved Flight Manual and the Pilots' Handbook, will be prepared in accordance with Air Transport Association Specification No. 100.



This specification was adopted by the scheduled airline industry to achieve uniformity in presentation to all airlines of information included in service and maintenance manuals. The format it establishes is the result of considerable study conducted by a special panel established within the Air Transport Association. The decisions it incorporates are now recognized on an industry-wide basis.

Conformance with this specification assures that Convair handbooks and manuals will meet the standards for the presentation of technical data set by the Air Transport Association of America for all manufacturers of aircraft, aircraft accessories, and component parts. Purpose of the specification, drawn up in 1956, is stated in its introduction as follows:

"To clarify the general requirements of the airline industry, with reference to technical data, its coverage and preparation.

"To provide an airline with the necessary data for use throughout its system in the operation, maintenance, and overhaul of equipment."

In order to standardize the treatment of subject matter and to simplify the user's problem in locating instructions, a uniform method of arranging material in all publications has been developed. When the content of certain publications does not lend itself to the full breakdown, authorized deviations are permitted by the ATA.

Convair will adhere uniformly to the standard chapter arrangement and breakdown to the maximum extent practicable, in its Maintenance, Wiring Diagram, Structural Repair, and Overhaul Manuals, and Illustrated Parts Catalog.

Major divisions of these publications will be identified as groups, and *secondary* divisions as systems. A system is a combination of interrelated components arranged to perform a specific function. Each system, as defined, includes the basic unit and all instruments, mechanical controls, electrical and hydraulic components related to that system.

When two or more systems are served by a single power source, that power source will be discussed separately under the appropriate chapter heading—either electrical, pneumatic, hydraulic, or vacuum. An example is the pneumatic system which supplies air to both the air conditioning system and the engine starters.

Among the major group and/or system subjects are AIRCRAFT GENERAL, AIRFRAME SYSTEMS, STRUCTURE, and POWER PLANT.

AIRCRAFT GENERAL is defined as the complete operational unit (airplane), and includes dimensions and areas, lifting and shoring, leveling and weighing, towing and taxiing, parking and mooring, required placards, and servicing.

AIRFRAME SYSTEMS include all aircraft systems except the power plant package.

STRUCTURE covers the airframe structure minus systems.

POWER PLANT encompasses the complete power unit which develops thrust. It excludes such items as generators, tachometer generators, and cabin superchargers.

In addition to uniform chapterization, the Convair "880" manuals will follow a standard numbering procedure, which will enable the operator to locate a specific subject with equal facility in each of his manuals.

Basic publications which will be delivered to the purchasers of the Convair "880" are described in the following paragraphs:

CAA APPROVED FLIGHT MANUAL

Prepared in accordance with Civil Air Regulations, a CAA approved Flight Manual will be supplied with each airplane for the information of the flight crew. This manual will contain specific CAA authority covering essential operating limitations and procedures, and will include airplane performance information. Its contents will be limited to operating procedures which may be considered new, unusual, or unique to the "880." Performance curves printed in the Flight Manual will be prepared on screened grids to facilitate their use and reproduction. The loose leaf binding will allow easy insertion of revisions.

PILOTS' HANDBOOK

The Pilots' Handbook will contain text and illustrations to supplement the Flight Manual. It will briefly describe and illustrate the major functional systems of the airplane, and will list all normal and emergency operating procedures for easy checking and quick reference. Crew familiarization with the "880" will be the primary objective of the Pilots' Handbook. Like the Flight Manual, it will be bound in loose leaf form to permit additions, revisions, or deletions.

MAINTENANCE MANUAL

The Maintenance Manual will contain complete instructions for ramp, line, and hangar maintenance of all installed systems and components, including vendor equipment and airline-furnished equipment installed in the aircraft during production. It will be prepared for the mechanic who normally performs work on units, assemblies, and systems while they are installed in the airplane, and not for the overhaul shop mechanic. This is in conformity with the new specification concept which requires that overhaul information be published in a separate manual.

Written simply and understandably, it will describe the location, operation, trouble-shooting procedures, operational tests, lubrication, general servicing, and inspection for all systems, subsystems, and components of the airplane. Drawings and illustrations will provide visual guidance to supplement the text. These same descriptive portions will be used in the Convair, airline, and home-study training programs.

OVERHAUL MANUAL

The Overhaul Manual is intended to provide overhaul instructions and an illustrated parts breakdown for all installed equipment and accessories which are subject to overhaul. Excepted are simple and inexpensive items such as switches and relays, on which overhaul is not economically feasible.

The Overhaul Manual will contain brief descriptive information and detailed step-by-step instructions and data covering any overhaul work normally performed on a Convair-designed unit away from the airplane—excluding structural repair. It will be designed for the mechanic who normally performs shop work—not for the aircraft service mechanic. Power Plant buildup instructions and landing gear overhaul instructions will be included in the manual.

Components which are not Convair-designed will be covered by overhaul instructions and illustrated parts breakdowns to be furnished airline operators directly from equipment manufacturers. This information may be inserted in the manual by the airline operator.

WIRING DIAGRAM MANUAL

The wiring diagrams used in the Wiring Diagram Manual will be reproduced from the diagrams prepared by the Engineering Design groups for use in

the manufacture of the aircraft. A separate Wiring Diagram Manual will be prepared for each airline customer, and will illustrate each installed circuit. The diagrams and schematics contained in the manual will be adequate to permit trouble-shooting and servicing of the circuits.

STRUCTURAL REPAIR MANUAL

This manual will contain descriptive information and specific instructions and data pertaining to the repair of secondary structure, and the repair of such primary structure as is adaptable to field repair. Typical simple and tabulated skin, leading edge, stiffener, frame, rib, and stringer repairs will be covered in the initial issue of the manual. Also included will be information on approved material and fastener substitutions, special repairs and related procedures, and extrusion tables.

As service experience indicates the need for specific repairs such as those developed to remedy fatigue and corrosion problems, actual repairs which are of general interest will be distributed to "880" operators as revisions to the Structural Repair Manual.

ILLUSTRATED PARTS CATALOG

Ready reference to help the operator identify parts for stock ordering will be provided in the Illustrated Parts Catalog. This catalog will present component breakdowns of structure and equipment in disassembly sequence; exploded views or cutaway illustrations of all parts and equipment manufactured by Convair, and those items of equipment purchased by Convair for exclusive use on Convair aircraft. Vendor end items, both Convair-designed and vendor-designed, will be included in the Parts Catalog, but will not be broken down in detail.

REVISIONS

Regular revisions to all manuals and catalogs will be issued as required to cover all delivered airplane configurations, and to reflect airline and Convair service experience. Temporary manual revision sheets will be issued as required to expedite the release of important manual changes to the airlines.

Illustration Plan

A new concept in presenting the illustrations which supplement "880" text material is now being developed which will provide coordinated visual presentations in the maintenance, training, and structural repair manuals, and the parts catalog.

Using a master illustration created photographically from plastic structure models as the primary art source, detailed same-size or enlarged segments pertaining to the system, part, or component in question will permit easy visual identification without variance in perspective or angle, and in proper relation to the whole.

The new plan will provide the service and maintenance men at the customer facility with a standardized set of illustrations, and will eliminate the confusion formerly caused by dissimilar views of identical subjects in the different manuals. Illustrations will be interchanged where practicable, thus helping to preserve visual compatibility.

The new illustration plan will help to explain an "880" system by means of a series of drawings designed to present the subject matter chronologically, according to its degree of technical content.

An example of the new plan's function, as represented by another Convair airplane, is illustrated on pages 8, 9 and 10.

1 This method is used to eliminate necessity for laying out to scale the basic views of aircraft structure, which are required in preparation of handbook drawings.

2 & 3 These drawings will be prepared at start of program and will be used for Structural Repair Manuals. They will also serve as basic aircraft outline drawings and basic structure in preparation of equipment and system installation and location drawings, as required by Maintenance Manual, Parts Catalog, and training.

4 System and equipment installation drawings will be prepared to standard breakdown and format so that they can be used as needed in Parts Catalog, Maintenance Manual, and training.

5 Location type drawings are required where equipment is distributed throughout aircraft. Detail drawings of individual installations will be subsequently made,

using illustrations in step 4.

6 These drawings will provide detail operation and maintenance information of ground support and vendor equipment. Some are applicable to, and will be used in Maintenance and overhaul manuals.

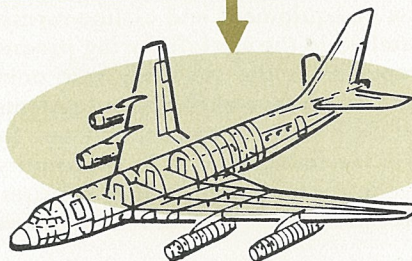
7 8 9 & 10 Drawings, as required, for specific publications and/or for training use.

A is to be used in conjunction with tracing camera, and photographed for preparation of drawings requiring external odd angle views of aircraft.

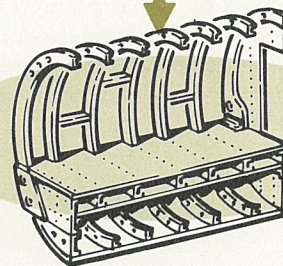
B is to be used in conjunction with tracing camera, and photographed for preparation of drawings requiring odd angle views of aircraft main structure and compartments.

C Prepare system schematics which include Maintenance Manual and Training requirements.

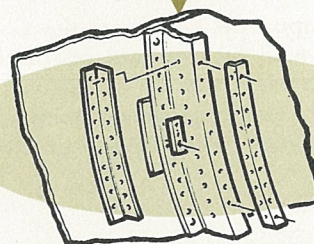
STRUCTURAL REPAIR GROUP



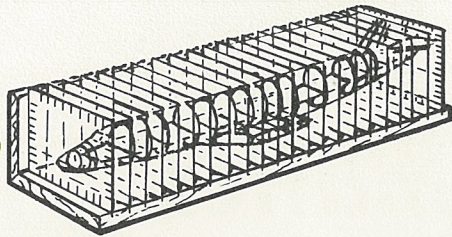
2 Prepare line drawings of aircraft by tracing film positives. Same size and enlarged copies are obtained.



3 Prepare complete structure drawings of major fuselage sections, wing, empennage, nacelles, etc., using enlarged copies of prepared outline drawings.



7 Prepare detail drawings required for Structural Repair Manual.



1 Plexiglas plates, representing station points and containing cross-section outline reproductions of frames, bulkheads, and panels, are arranged in jig and photographed. Photographs are taken at preselected angles in fwd and aft views. Film positive copies are made.

PARTS CATALOG GROUP

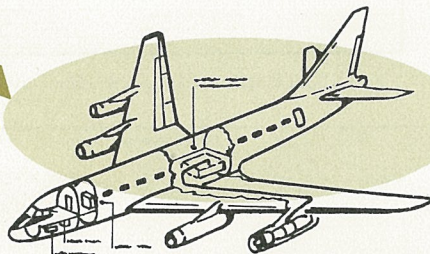
MAINTENANCE MANUAL GROUP

TRAINING GROUP

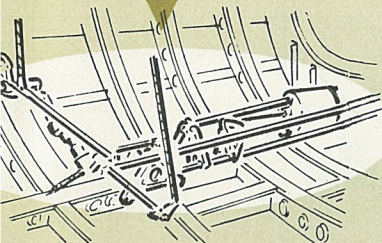
System
Schematics

C

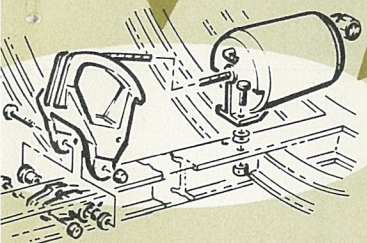
Maintenance Manual
and Training



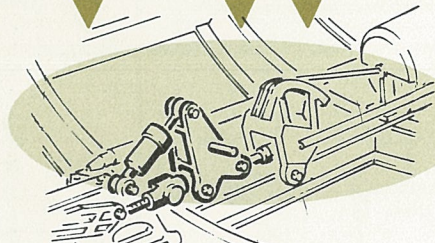
5 Prepare general location
drawings of equipment.



Prepare equipment and system in-
stallation drawings which overlay
structure drawings.



Prepare detail drawings required
for Parts Catalog.

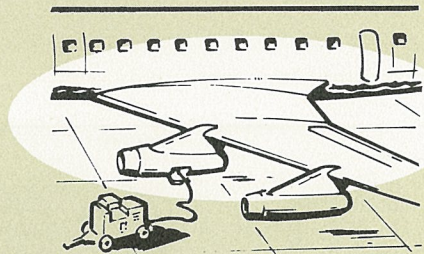


9 Prepare removal, installation, rig-
ging, and adjustment drawings.

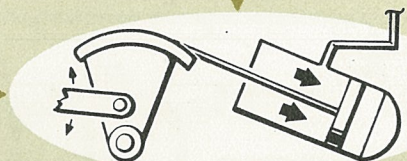


A Make small scale model of aircraft
with extended landing gear, and
outlines of all access doors and
panels.

B Make small scale model of air-
craft major structure and
compartments.



6 Prepare drawings required for
ground support and vendor equip-
ment.

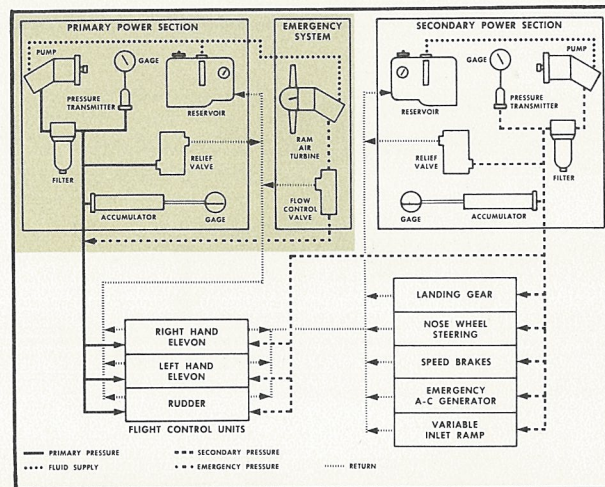


10 Prepare additional drawings re-
quired for training purposes that
are not required for Maintenance
and overhaul manuals.

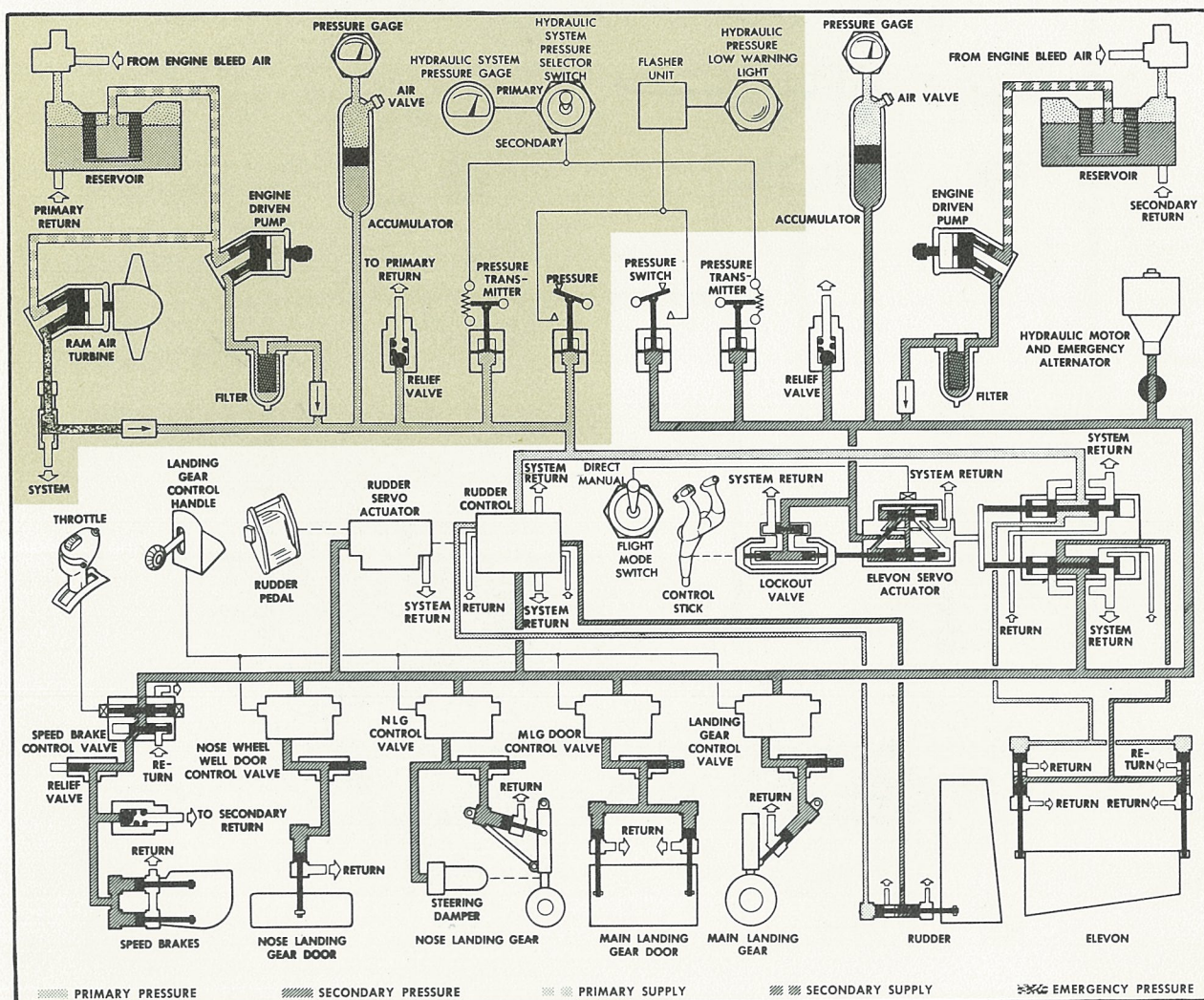
Training schematics

A basic over-all descriptive drawing in the form of a system block diagram will identify the main unit content and its interrelation and interconnection. The second illustrative step will depict the control and flow of a system in simplified form. Following this, a more detailed description of system flow, control, and unit function will be presented.

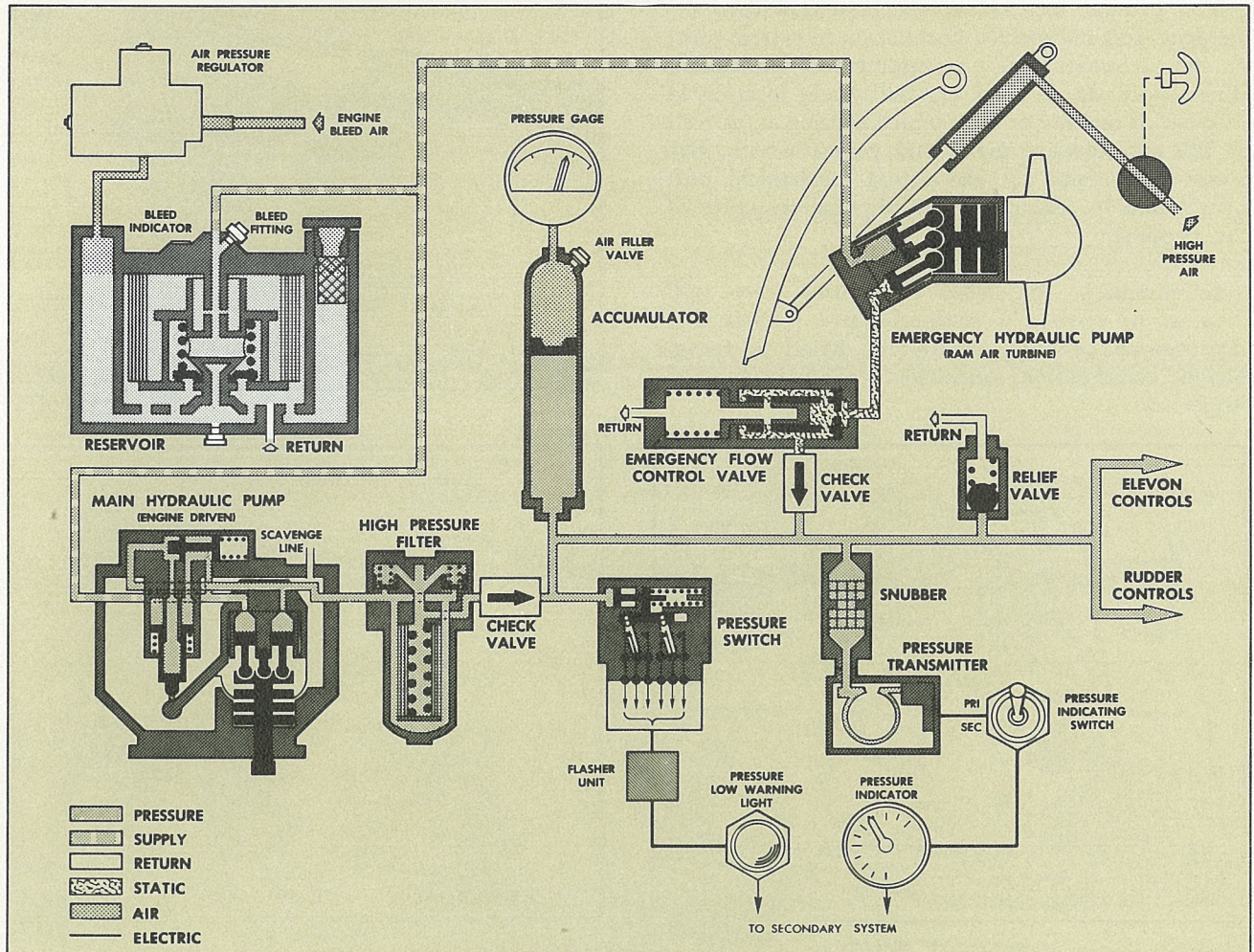
Next in sequence are illustrations of the major segments of a system, required when components of a complex nature must be broken down, identified, and explained. Together with those preceding them, they will portray the functional and operational aspects of a system.



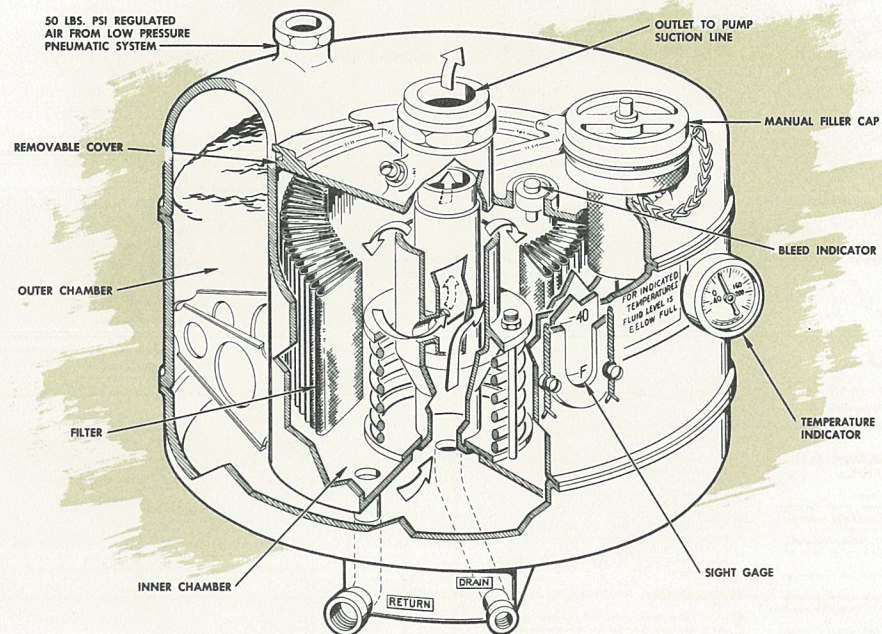
AIRPLANE HYDRAULIC SYSTEM—BLOCK DIAGRAM



AIRPLANE HYDRAULIC SYSTEM—FUNCTIONAL SCHEMATIC



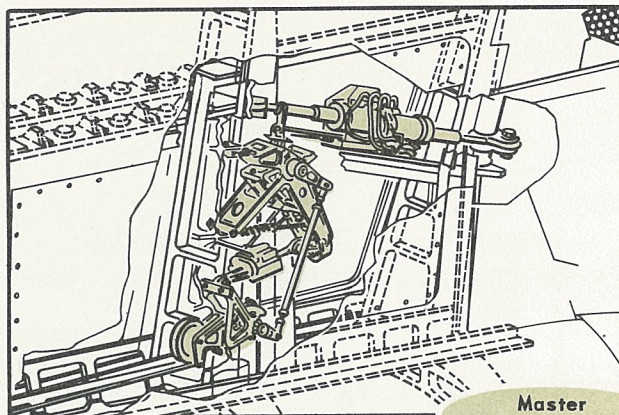
PRIMARY HYDRAULIC POWER SYSTEM—OPERATIONAL SCHEMATIC



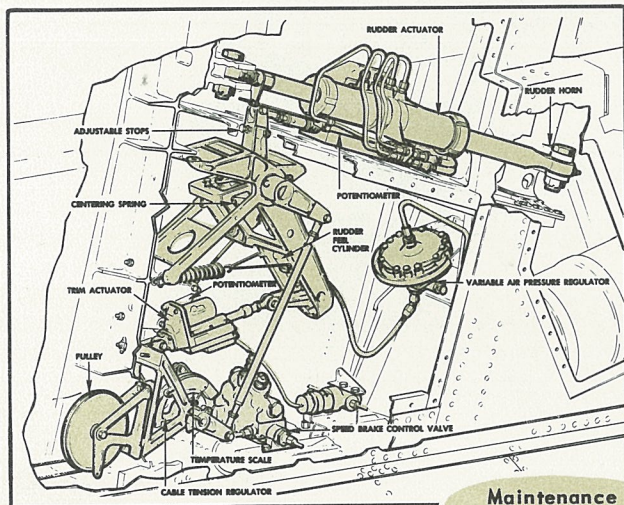
HYDRAULIC SYSTEM RESERVOIR UNIT OPERATION AND CONSTRUCTION

The general location of the system within the airplane, and the specific installation of system units in the airframe, will be presented in subsequent illustrations which show (1) the system location in relation to the bay or bays which contain it, as well as the maintenance doors and panels which give access to it; and (2) the actual mechanical unit installation in relation to the physical structure of the airplane.

In summary, the "880" illustration plan will attempt to present a comprehensive sequence of illustrations covering details for location, recognition, construction, operation, maintenance, and inspection.

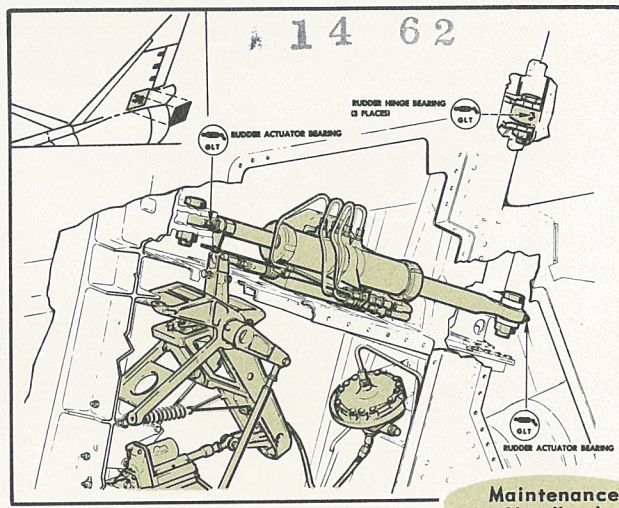


Master Drawing



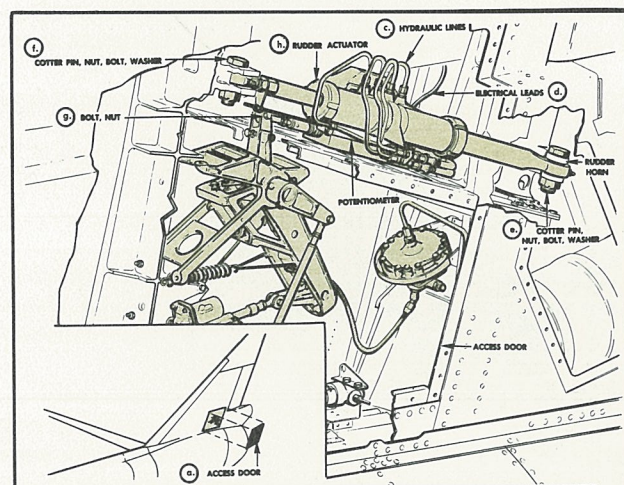
Maintenance Handbook

Rudder Control System (Sheet 2 of 2)



Maintenance Handbook

Rudder Component Lubrication



REMOVAL RUDDER HYDRAULIC ACTUATOR AND CONTROL VALVE.

1. Open rudder actuator access doors.
2. Make sure that electrical power is off the airplane, and that primary and secondary hydraulic system pressures have been relieved.
3. Disconnect hydraulic lines from control valve ports; cap lines and ports, and clean up of once all spilled hydraulic fluid.
4. Disconnect electrical leads from servo actuator and potentiometer.
5. Remove cotter pin, nut, bolt and washer securing actuator cylinder to rudder horn. Carefully remove split-cone bushings from horn.
6. Remove cotter pin, nut, bolt, and washer securing rod-end of actuator piston to fuselage support fitting. Carefully remove actuator.

7. With actuator on bench, cut safetywire on rod-end jam nut; loosen jam nut, and remove rod-end from actuator piston.
8. Loosen check nuts securing potentiometer shaft to potentiometer horn, and remove horn from actuator.
9. Cut safetywire from three nuts securing potentiometer to actuator. Remove two main potentiometer support balls, and remove potentiometer from actuator and retain for installation or replacement actuator.

INSTALLATION.

10. Install potentiometer horn and rod-end on actuator piston, and hand-tighten rod-end jam nut.
11. Adjust length of piston.

Maintenance Handbook

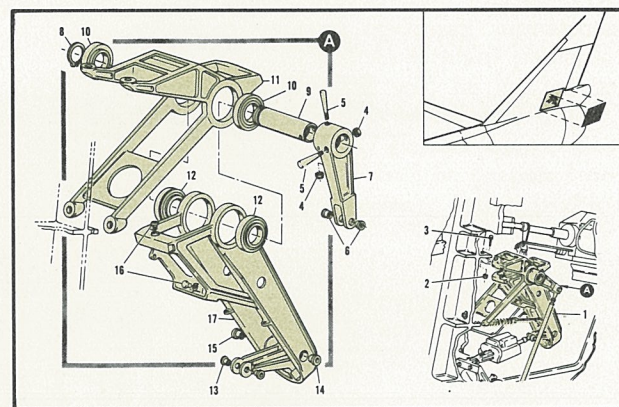


Figure 245. Support Installation Rudder Feel & Trim

FIGURE AND INDEX NUMBER	PART NUMBER	DESCRIPTION	UNITS PER ASSY.	USABLE ON CODE FROM TO	"X" INDICATES LATEST REVISION
245	8-42610	SUPPORT INSTALLATION: RUDDER FEEL AND TRIM STA 472 SEE FIG. 31 FOR NHA	1		
- 1	8-42610-1	SUPPORT ASSY, RUDDER FEEL AND TRIM	1		
- 2	H10-42B	ATTACHING PARTS	4		
- 3	ANA-6A	NUT, KNN 98-37543-003	4		
		BOLT	4		
- 4	8-42609-1	SUPPORT ASSY, RUDDER FEEL AND TRIM	2		
- 5	H10-1032	ATTACHING PARTS	4		
- 6	AN386-1-14	NUT, KNN 98-37543-002	4		
- 7	KP290KE5806	PIN	2		
- 8	8-42609-7	BEARING, PAF	2		
- 9	3100-17M	SUPPORT	1		
- 10	8-42211	LOCK RING, WK1 97-61509-001	1		
- 11	8-42607-9	SHAFT	1		
- 12	NA577-4-18	BEELCHANE ASSEMBLY	2		
- 13	8-42610-2	BUSHING	2		

Parts Catalog

MISCELLANEOUS PUBLICATIONS

Other publications which will support the new "880" jet transport operation include weekly and monthly field service periodicals, regularly-issued progress reports, and special booklets and brochures as required to describe specific phases of the airplane and its components.

A Convair "880" Progress Report, issued periodically, began publication in January 1957, and has followed developmental and structural phases of the new aircraft since that time. Its articles have dealt with such topics as tooling and equipment, cabin interior and fuselage section mockups, manufacturing processes, and design and testing.

As airplanes reach delivery stage, a newsletter type publication will be distributed to Convair operators, and Convair personnel at home and in the field. This publication will aim to keep operators and Field Service Engineers up-to-date on all operational and maintenance phases of the "880." Besides providing Convair engineering information, this weekly newsletter will contain reports of any service problems, and experiences from operators and service representatives.

The Convair Traveler will continue to provide the airline operators with information of a helpful and beneficial nature. As design is finalized and the airplane is in full production, operators will be given information on systems and component parts through the medium of the Traveler so that this information can be integrated into the operators' training programs. The information presented in this publication will supplement information found in the handbooks.

1 4 6 2

Service Publications Personnel

The Engineering Service Publications Section is divided into four distinct groups which function as a unit to supply SERVICE through the medium of its many and varied publications. These different groups require the talents of personnel in many fields, from writers, catalogers, and artists to those well-versed in printing and production procedures. The four groups—Handbooks, Parts Catalog, Special Projects, and Illustrations—are staffed by people who are thoroughly experienced in the respective functions they perform. All of the printed material produced by this Section serves a common purpose—to provide the

Convair customer with a complete and up-to-the-minute factual background of the aircraft he operates.

Thus the same skilled craftsmanship which is now accompanying the actual construction of the Convair "880" is also the underlying factor behind every publication produced by the Service Publications Section. As prolific contributors to the service needs of Convair-Liner operators in the past, the members of this team have aligned themselves with the rest of the Convair family in underwriting customer service for the new "880," which is destined to play a major role in the commercial jet age which lies just ahead.

SERVICE PUBLICATIONS

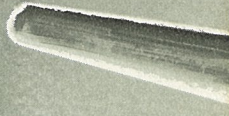
HANDBOOKS

PARTS CATALOGS

SPECIAL PROJECTS

ILLUSTRATIONS

14 62



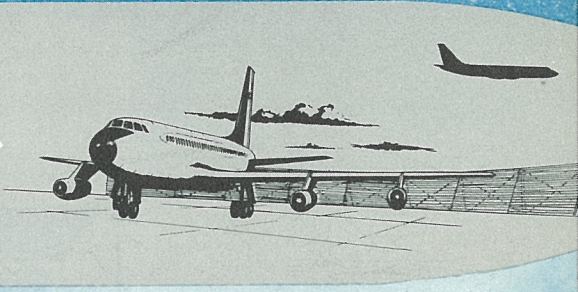
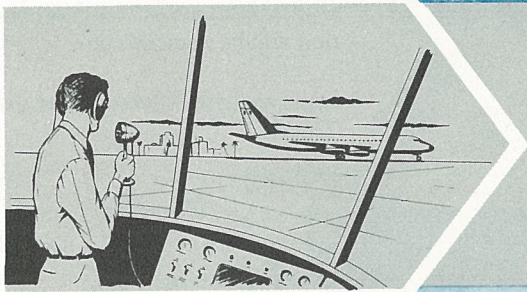
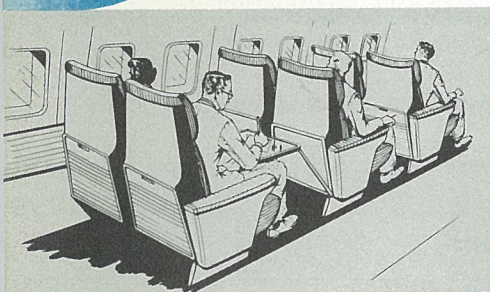
CONVAIR

Traveler

VOLUME IX

NUMBER 6

NOVEMBER 1957



CONVAIR *Traveler*

VOLUME IX NUMBER 6 NOVEMBER 1957

Chief Engineer
R. L. Bayless
Manager of Service
J. J. Alkazin

Chief — Service Publications
H. R. Kennedy

Chief — Transport Service
L. J. Bordelon

Chief Aircraft Change Service
O. W. Harper

Editor
G. S. Hunter
Writer
Van Hedges
Art Editor
N. J. Rutherford

ON THE COVER

The correlated flight and ground procedures which will assure safety and convenience for passengers of the Convair 880 jet transport serve as the theme of Artist George Paul's cover design.



FOREWORD

Arrival of the jet age in commercial air transportation signals the establishment of certain new operational methods for airline operators, involving both flight and ground procedures.

The Convair 880 jet transport, leading contender for operator and passenger approval in the short-to-medium range flight field, has been designed to make the change-over from propeller to jet power without major modification of existing airline facilities.

Integration of the "880" into present airline facilities will result in some differences in operation, servicing, and maintenance procedures, but, because the airplane is adaptable to numerous procedures now in use, the transition will be a smooth one.

Some of these differences are discussed in this issue of the *Traveler*.

Copyright 1957

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of Convair-Liner operation and service published monthly by the Service Publications Section of Convair in the interest of Convair-Liner operators. Communications should be addressed to Manager of Service, Convair, San Diego 12, Calif.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without specific approval of their cognizant organization.

Convair 880

SUPPORT PLANNING

Operation of the Convair 880 jet transport, first deliveries of which are scheduled to be made late in 1959, will be influenced by factors which are unique to the jet age. At the same time, some of the current procedures which apply to the operation of reciprocating engine aircraft will still be effective.

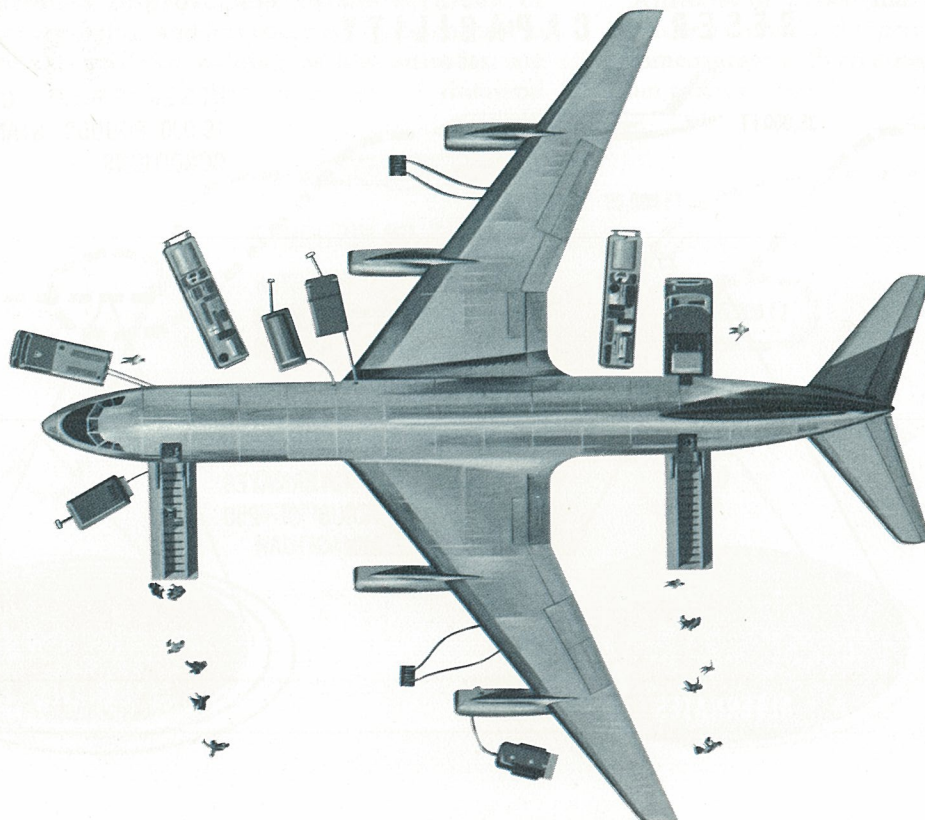
A practical combination of the old and new procedures, which it is expected will govern operation of the airplane, has been developed by Convair, and is being presented to future "880" operators in anticipation of some of the problems they may encounter during the transition from propeller-driven to jet aircraft.

In arriving at a preliminary concept which would acquaint potential operators with such procedures as flight operations, ground operations, handling, terminal parking, servicing, and maintenance, Convair realizes that certain unresolved problems may necessitate later changes in this current philosophy of Convair 880 operational phases. As compiled by the Operational and Support Planning Group of the Convair Engineering Department, the information embodied in this philosophy is presented primarily as a recommended support system for the "880."

The planning for jet transport operations necessarily encompasses two broad areas of activity. The first includes all factors governed by outside agencies, such as development of airports, alteration of airway traffic control system methods, and improvement of weather reporting procedures.

The second area includes all matters for which the airlines themselves will assume primary responsibility, such as hiring and training of personnel, development of efficient operations procedures, and planning of schedules and maintenance programs.

Under the subject of Flight Operations, the Operational and Support Planning Group has compiled studies of anticipated conditions at several theoretical "880" destinations. In regard to Ground Operations, Convair has proposed concepts which require minimum deviation from present practices. This approach is believed to be suitable to the Convair 880, because this airplane is expected to be the only commercial turbojet transport operating into certain high-altitude or short-field terminals.



FLIGHT OPERATIONS

Probably one of the most important considerations of flight operations will be the planning of fuel reserves. Fuel reserves, or holding capability, for the jet transport will be comparable to those for reciprocating engine aircraft, in terms of time available. However, because these reserves represent greater weights with jet aircraft, they take on added significance as an economic factor. Because they are affected significantly by holding altitude, they may present the necessity for a change in flight operating procedures.

Sample flight data on representative routes are presented to give a general idea of some of the probable operating characteristics of the Convair 880.

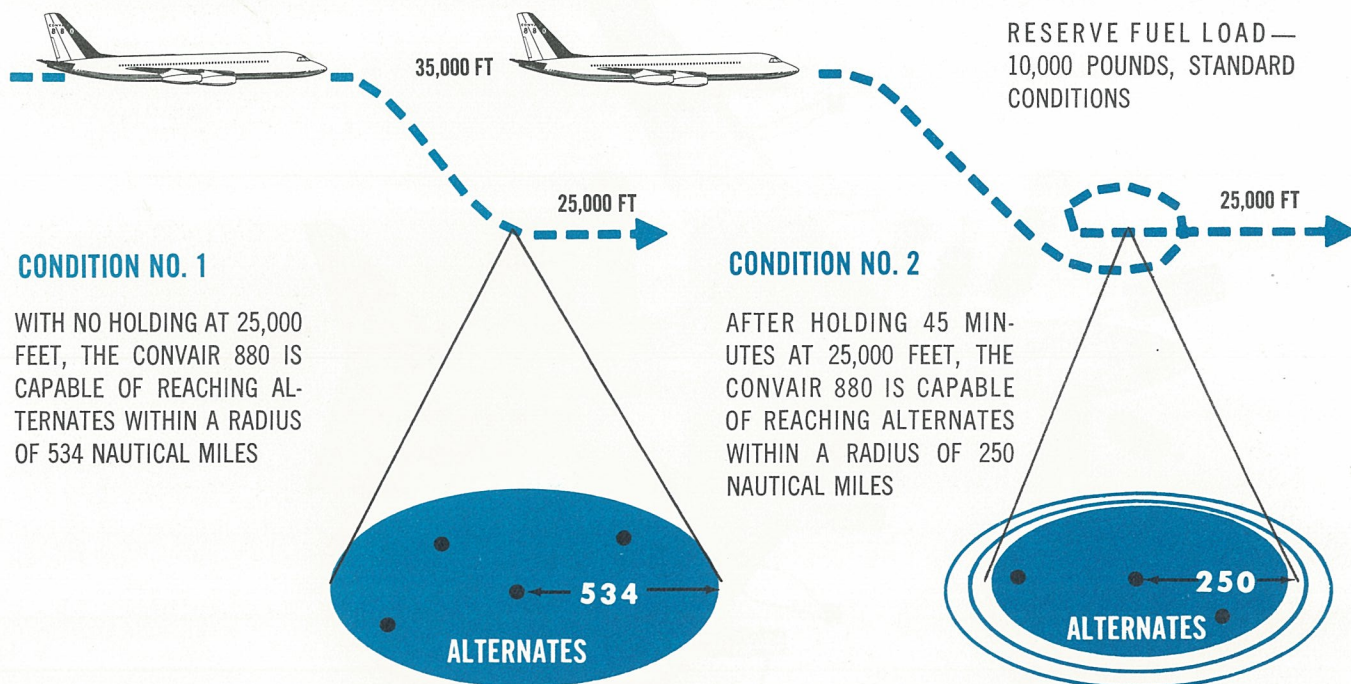
By cruising at 35,000 feet, maximum economy on most anticipated "880" routes is possible. Where speed is more important than range or operating economy, due to competitive schedules, etc., lower altitudes (25,000 to 30,000 feet) may be necessary. By climbing and descending rapidly and by holding at approximately 25,000 feet, economical operation is

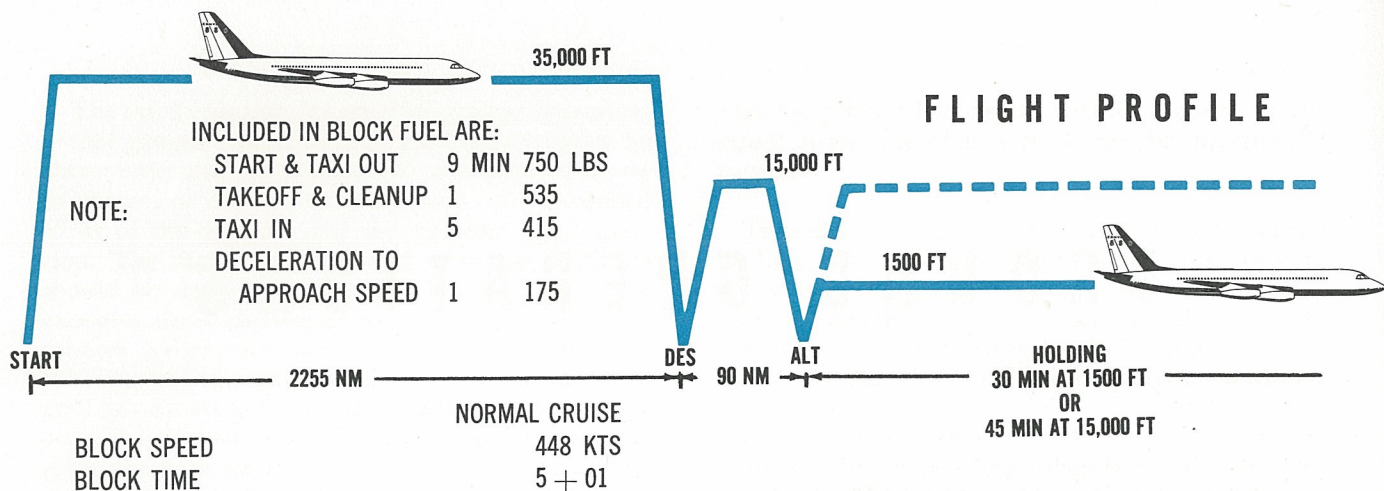
possible. On shorter flights, the most economical cruising altitude may be determined by the relationship of climb and descent times to the length of time in cruise.

Ability of the "880" to accomplish fast climb to cruising altitude, and equally rapid descent prior to landing, is a feature that contributes to its low direct operating cost. Passenger comfort is assured at all times during these accelerated maneuvers through the maintenance of sea level cabin air pressure at altitudes up to 21,000 feet, as compared with 9,000 feet on the Metropolitan 440. The "880" can reach the ground from 25,000 feet in only eight minutes, while it takes the same amount of time for the 440 to descend from an altitude of only 8,000 feet.

If the reserve fuel or holding capability of the aircraft for any given flight plan is considered in terms of distance rather than time, and if holding is accomplished at 15,000 to 25,000 feet, then the accompanying charts present a reasonable approach to the problem of planning reserve fuel loads. By "reason-

RESERVE CAPABILITY





AIRCRAFT OPERATING WEIGHT	
EMPTY (DOMESTIC)	84,933
PAYLOAD, STANDARD	22,360
OPERATING ZERO FUEL WEIGHT	107,293 POUNDS
RESERVE FUEL	
ALTERNATE 90 NM: AT 15,000 FT	3,000
30 MIN HOLDING AT 1500 FT	5,450*
LANDING WEIGHT AT DESTINATION	115,743 POUNDS
BLOCK FUEL	47,000
TAKEOFF WEIGHT	
AT STARTING POINT	162,743 POUNDS
* OR 45 MIN AT 15,000 FT — 5200	

able" it is meant that, with the reserves indicated in the charts, the pilot may make an approach under marginal weather conditions if he elects to do so.

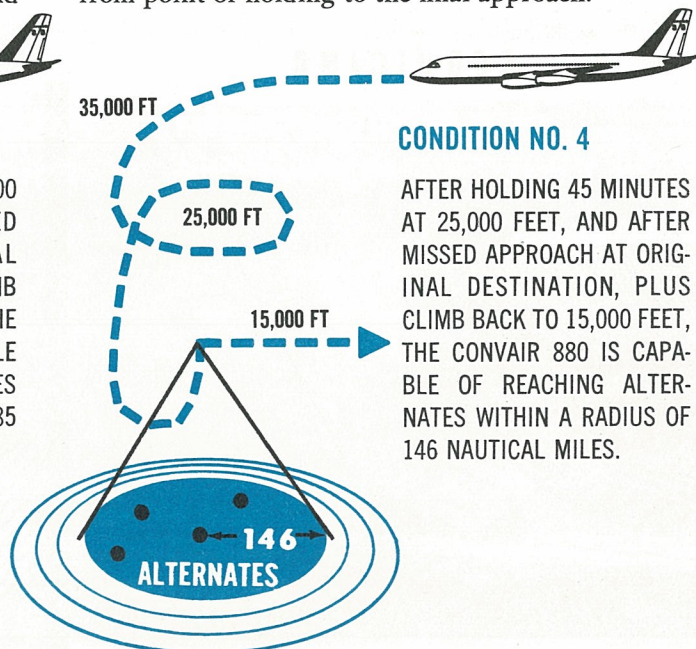
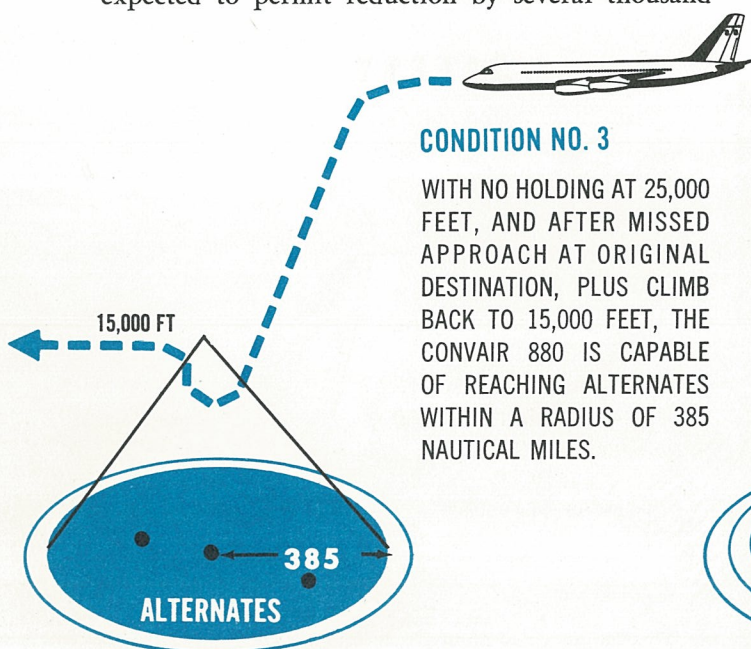
Continued improvement in the accuracy of weather reporting, and improved air traffic control to obviate the need for holding at low altitudes, are expected to permit reduction by several thousand

pounds of the fuel reserves presented here. The additional fuel thus realized can either be used to assure an extended holding pattern, or to enlarge the choice of alternate destinations. The operator may also elect to substitute added payload in its place.

Such improvement can come about only as a result of experience and technical development, encouraged by a combined effort of interested operators and responsible agencies of government. In the meantime, it is advisable to base plans on present conditions rather than on problematic future development.

Reserve fuel loads, as presented in the illustrations, are in excess of 15-minute maneuvering fuel and the allowance for taxi. The charts reflect fuel consumption data for standard conditions (59°F at sea level). Humidity effect is negligible.

Altitudes of 15,000 and 25,000 feet were selected in order to obtain the greatest operating efficiency, commensurate with an acceptable short-time interval from point of holding to the final approach.



GROUND OPERATIONS

Ground operations, as treated herein, include all activities associated with the operation of the Convair 880 on the ground—taxiing to a gate position, servicing and loading, and departure from the gate—and those facilities and items of major equipment which support such activities.

Certain facets of ground operations with jet transports require the immediate attention of the administrative staff in the interest of future operating efficiency and economy. When expansion and development of airport and terminal facilities are contemplated, the operator should be prepared to present his future requirements effectively to insure that such developments provide adequately for jet operations. This is vital because the configuration of ground facilities determines the extent to which an operator may comply with the three cardinal principles of effective jet ground operations.

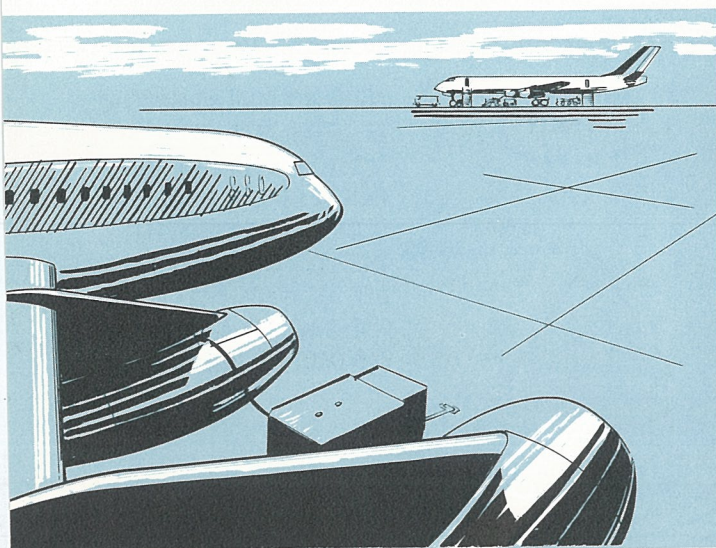
These principles state that operations on the ground under jet power should be conducted in such a manner as to preclude injury to personnel or dam-

age to equipment; that ground operations should not impose any excessive demands upon the passengers; and that they should be refined to the point where they will rarely be the cause of a delay in departure.

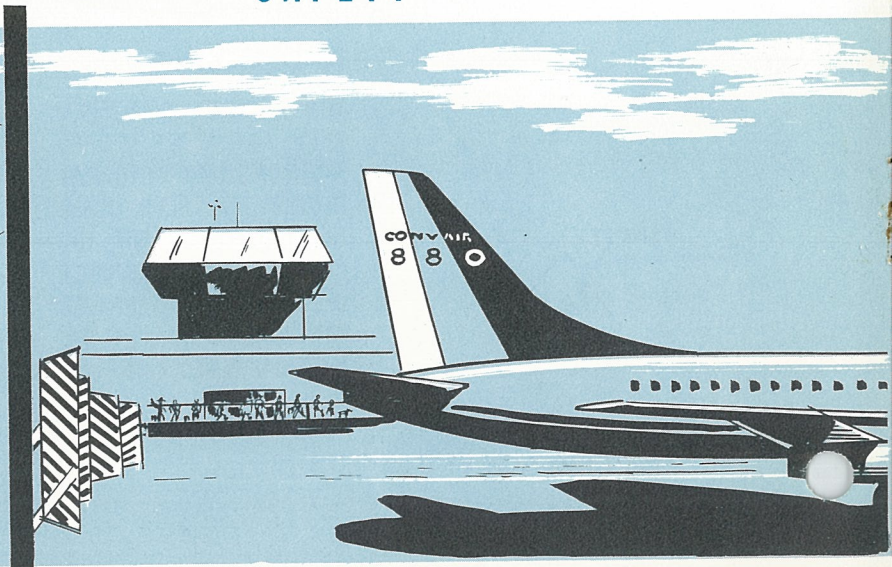
The requirement that ground operations not be a frequent cause for delayed departure arises from the fact that failure to meet schedules has a more adverse effect on jet aircraft than on slower, propeller-driven craft. Furthermore, such delays have an exaggerated cumulative effect on the scheduling of later flights assigned to the delayed airplane.

A more severe penalty which might result from frequent deviations from schedules may be the refusal of traffic control authorities to grant clearances before engine start. Prior clearance contributes significantly to the efficient and economical operation of jet transports. Without this control cooperation, fuel reserves will be unnecessarily depleted during standby engine operation, and noise and blast disturbance, although not critical, will be prolonged.

SERVICING



SAFETY



The third criterion for good jet ground operations—that ground movements of the aircraft under jet thrust must always be conducted so as to avoid injury to persons or damage to equipment—is a combined effort of the operator and the terminal administration. The ramp approach and departure taxiways should be designed so as to minimize the use of excessive thrust during ground operations while the exhaust outlets are directed toward the terminal, other parked aircraft, and public areas. The jet transport should always be parked in its specified ramp position so that marked danger areas may be vacated prior to engine start.

Where necessary, blast shields may be erected to avoid interference with adjacent activities. If maintenance operations include frequent engine runup, provision of a revetment or other blast-containing structure is desirable.

Given a terminal configuration which is satisfactory for jet operations, it will then become necessary for all personnel to maintain a state of safety consciousness which will preclude development of hazardous situations. For instance, the same alertness and good sense that prevent propeller accidents today will prevent jet accidents tomorrow. Certain unique hazards common to jet operation require that personnel be indoctrinated prior to their first contact with jet aircraft so that this safe state of mind can be firmly established.

The engine intake area is hazardous because there is no visible indication of the great force of the in-rushing air. The exhaust danger area is less likely to cause harm in the sense that the heat and noise of the jet blast create their own warning but personnel

must be prepared to expect a rapid increase in the extent of the hazard area whenever the throttles are advanced.

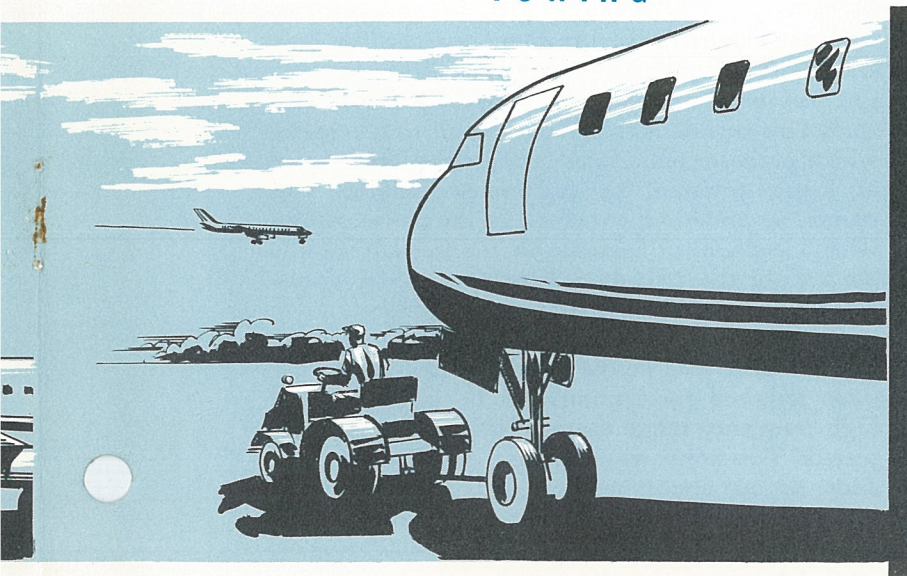
Takeoff clearance delays should be absorbed at the loading ramp prior to engine start. This prevents unnecessary interference with other aircraft, minimizes noise emission, and conserves fuel; it is made possible by the easy starting capability of the turbojet and by the fact that these engines need no warmup.

Handling the Convair 880 on the ground is essentially similar to handling other large aircraft. The "880" is highly maneuverable and easy to handle.

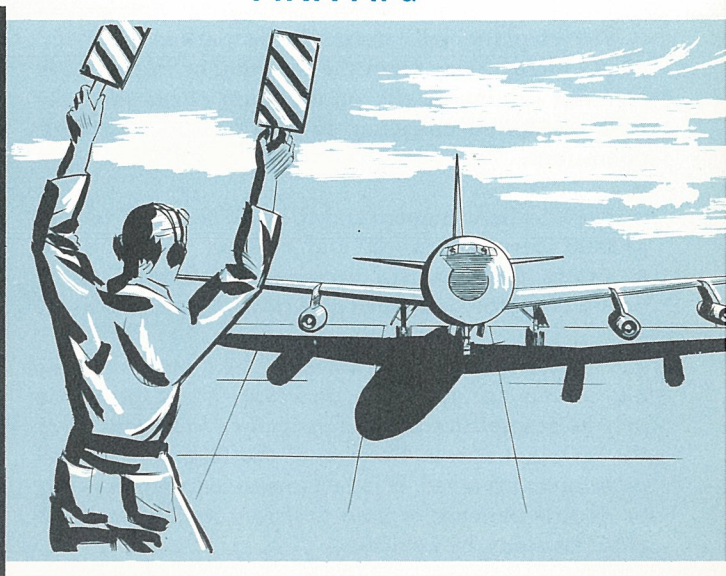
All four engines will be used when leaving the gate position, if the airplane is parked in the 45° position. The engines idle at 60% rpm, and taxi roll can be sustained with a 61.5% rpm setting. It is expected that 65% to 75% rpm will normally be adequate to initiate taxi roll out of the gate position. At this power range the heat and blast effects will be inconsequential in gate positions of 180- to 200-foot diameters. Excessively high rpm settings should be avoided during ground operations, particularly in the terminal areas. All personnel and service equipment must be cleared promptly from the caution areas before engine start.

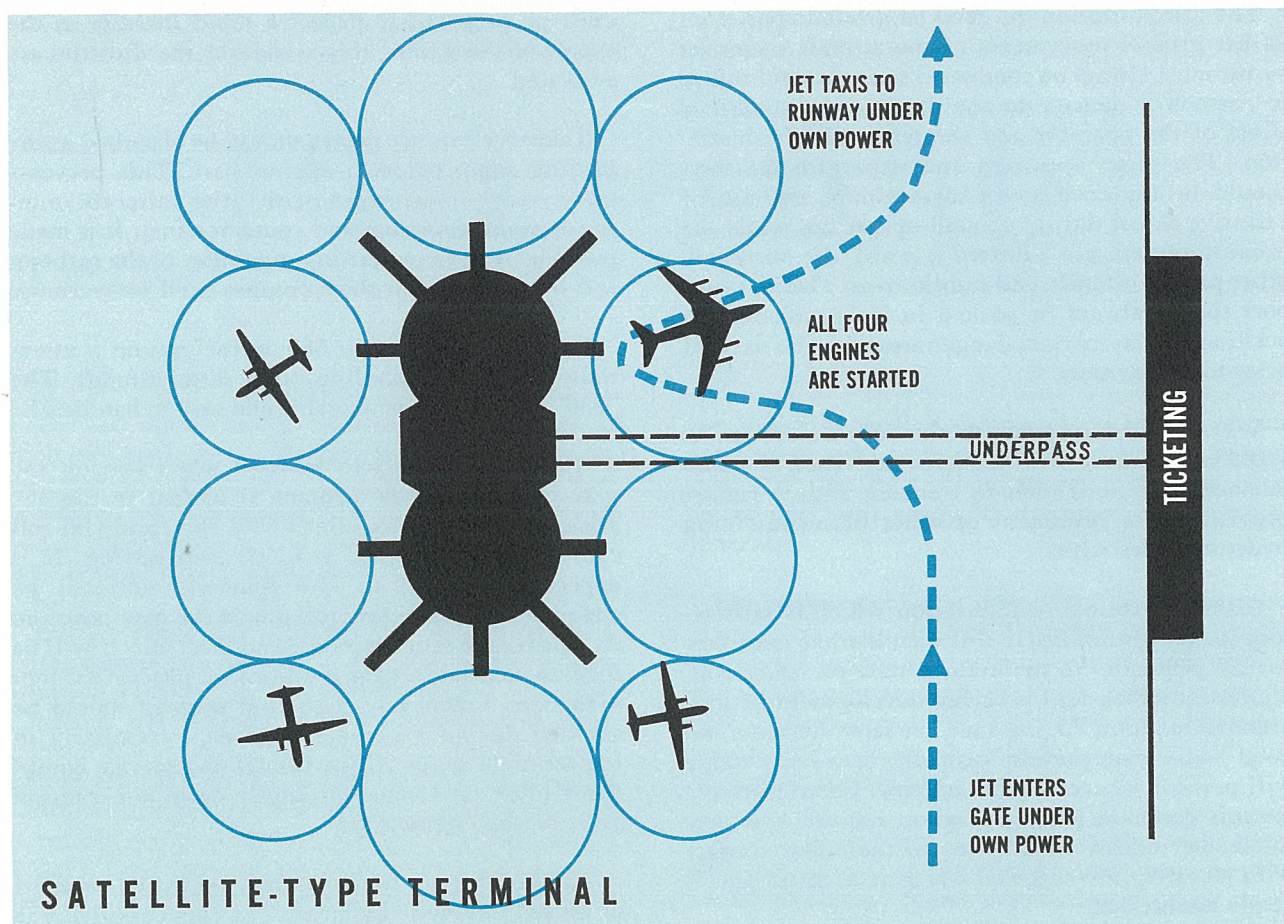
The Convair jet transport may be towed forward or moved in reverse by means of a conventional type nose gear axle tow-bar and a tug of suitable capacity. An a-c power source aboard the tug is required to provide light and communication power and for operation of the aircraft emergency hydraulic pump, to maintain adequate brake pressure during the towing operation.

TOWING



TAXIING





TERMINAL PARKING

(At locations where normal procedures are permissible)

The airplane will normally be parked at a 45° angle, facing away from the terminal or finger. This position minimizes the intake noise effect and permits maximum efficiency in servicing and loading operations.

The excellent maneuverability of the "880" on the ground permits taxiing and turning within areas presently provided for reciprocating-engine transports. Therefore, standard gate positions may be used.

The Convair 880 will normally be taxied into and out of conventional gate positions. These positions may be at satellites, along fingers, or contiguous with the terminal apron. Because of the large number of passengers involved, it is recommended that stacking or double parking at gate positions, or outboard of gate positions, be avoided.

Power required to taxi from the gate will be moderate (75% rpm or less), and, as previously stated, taxi roll may be sustained on level pavement by 61.5% rpm. This regime is for taxiing on all four engines, which is the recommended mode when taxiing out of a gate position. Taxiing on two engines will require an undesirable increase in the power setting with a consequent increase in the velocity of the blast aft of the exhaust nozzles; four-engine operation will minimize blast, heat, and noise levels.

Noise generated at the relatively low power settings required for taxiing will be largely in the high frequency range characteristic of the jet compressor. This noise, while intense, does not carry far, under normal atmospheric conditions. There will be little transmission of sound inside the terminal building, for example, if the building is suitably sound-

proofed on the ramp side. The number of persons remaining near the aircraft during engine operation should be the minimum necessary for safe handling. These ramp personnel should wear hearing protection devices.

When leaving the gate position, the pilot should use caution, and advance power only to the point required to initiate forward motion. The blast velocity and exhaust noise will increase rapidly as this minimum power setting is exceeded.

Structures adjacent to the gate position, such as finger terminals, should be designed so as to provide protection against 60-mph blast velocities. Velocities at the gate position should normally not exceed 50 mph, 150 feet aft of the exhaust nozzle. This is comparable to the wind created by large propeller-driven aircraft, but is more concentrated within the affected area. Blast fences may prove to be beneficial in gate positions where congestion and continuous activity are customary in adjacent areas.

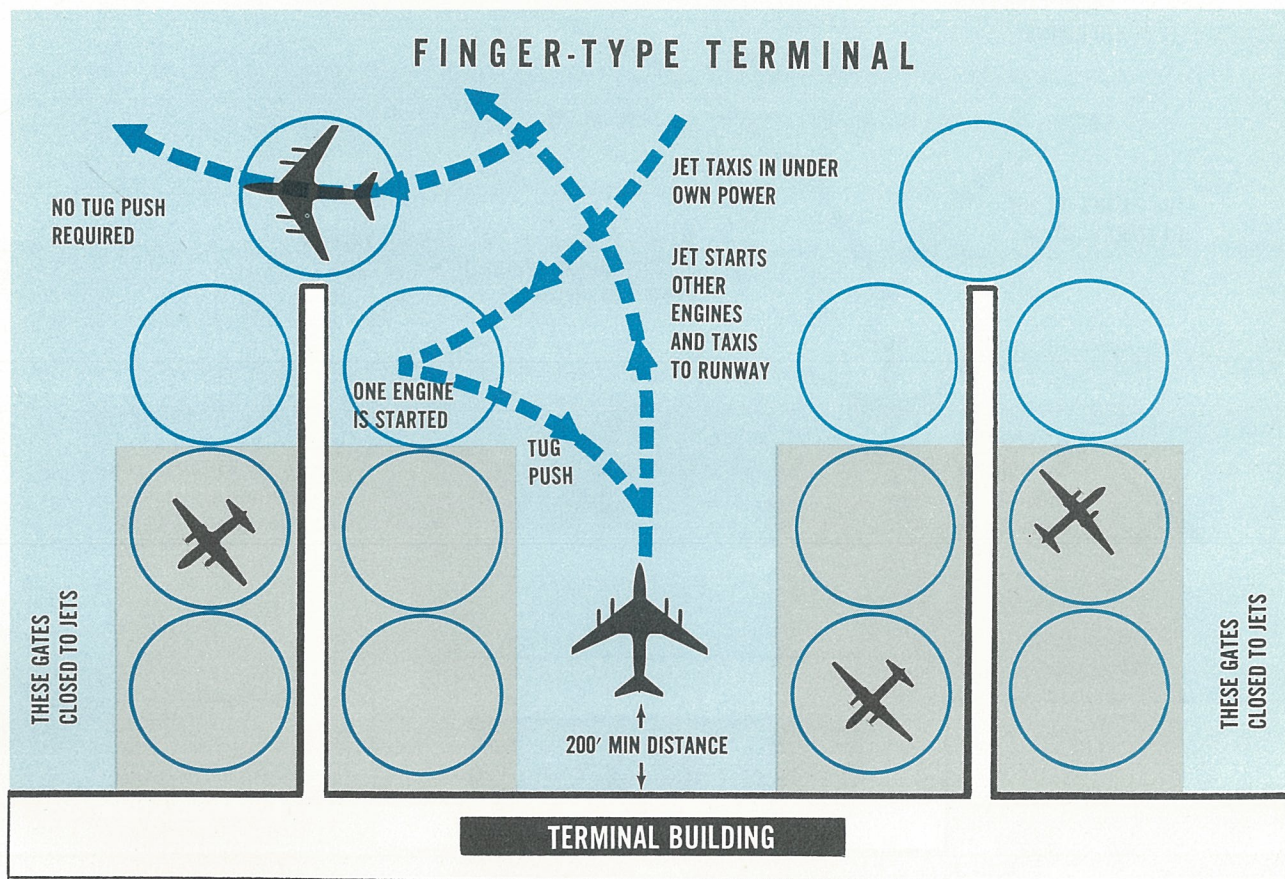
TERMINAL PARKING

(At locations where normal procedures are impracticable)

One of the questions to be resolved by the operators of jet transports is how to maneuver and park in the vicinity of the passenger terminal where jet blast interferes with neighboring operations.

Many proposals have been submitted for the con-

tainment of jet blast, including the use of special equipment, special configurations of terminal facilities, and restricted taxi paths. Other proposals penalize jet operations by requiring their isolation from other aircraft. Convair recognizes the merit of some parts of these proposals, but favors a simpler solution.



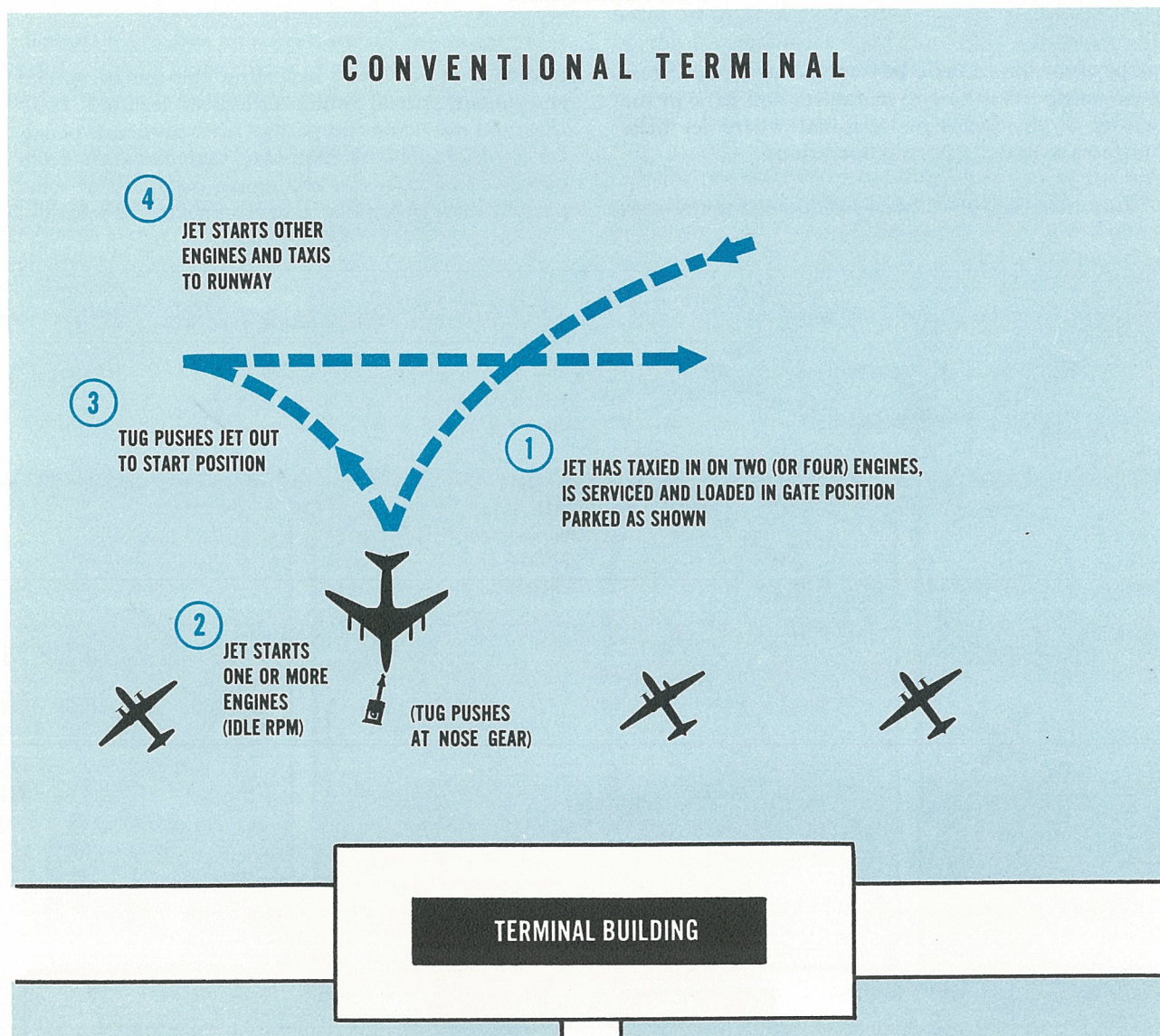
Where normal approach and departure procedures cannot be used, it appears feasible to taxi the jet airplane directly in toward a gate position without turning. This prevents jet blast from being directed toward nearby activity, and presents the forward door in a position close to the terminal for convenient deplaning and enplaning—an advantage for passengers. Servicing and baggage loading operations are not adversely affected by this parking position. The only apparent objection lies in the fact that it is contrary to traditional practice.

To depart, a standard tug of suitable capacity engages the nosewheel gear. After one or more engines are started with ground power, the aircraft is pushed directly to the rear until clear of the loading ramp area; it is then turned onto the taxiway as illustrated. The jet airplane can then taxi on two

engines to the runup area where the remaining engines are started by means of the integral starting system.

Special equipment could be procured to back the aircraft out of its gate position, such as special tugs which lift the nosewheel for the pushing operation. The use of such equipment is at the option of the operator. However, Convair recommends using the time-proved tug and towbar method of backing the airplane, because the "880" nose gear has been designed to permit this type of operation.

Where special provisions are made for jets at certain terminals, the Convair 880 will undoubtedly meet the requirements. However, Convair believes that, if necessary, any jet can be accommodated in the manner illustrated.



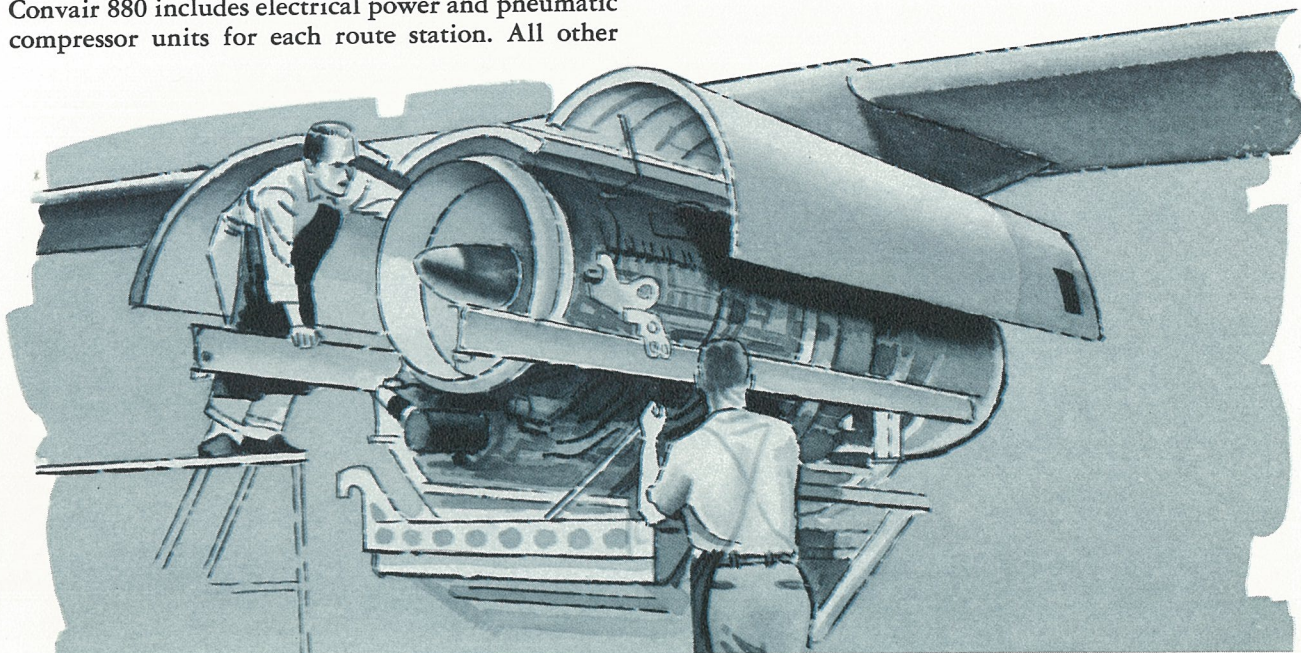
SERVICING

The age of jet transports imposes no extraordinary servicing requirements in the areas of equipment, manpower, or time. Convair 880 ground operations are a direct development of practices to which operators have been accustomed for years. The "880" will be serviced in approximately 24 minutes from engine shutdown to restart.

New equipment required for the support of the Convair 880 includes electrical power and pneumatic compressor units for each route station. All other

servicing functions can be accomplished with adaptations of existing equipment.

The "880" has a four-point, underwing pressure fueling provision with an acceptance capacity of up to 300 gpm per hose at 50 psi. All four points may be serviced simultaneously.



MAINTENANCE

A special group within the Engineering Department at San Diego is assigned exclusively to the monitoring of all design development on the "880" airframe to assure optimum maintainability. Support equipment requirements are also under surveillance of this group.

In the light of the work done to date to assure the maintainability of "880" design, it is apparent that operators who are experienced in the maintenance of other large aircraft will be able to integrate the Convair 880 into their operations with ease.

The General Electric CJ-805-3 jet engine, used to power the Convair 880, is inherently simpler than the modern reciprocating engine. This relative simplicity is reflected in both line and maintenance overhaul operations. However, it must be recognized that different techniques are required; thus an extensive advance training program is necessary.

Comparing the turbojet with the reciprocating engine, the need for trouble shooting and trouble-shooting devices is less for the turbojet by virtue of its design. Nevertheless, jet engines present maintenance problems requiring special procedures and equipment. Exhaust gas temperature probe calibration units and fuel control system test units are examples of the special equipment required. Similarly, jet engine inspection procedures differ from those required for reciprocating engines.

It is anticipated that engine and accessory manufacturers, in conjunction with the armed forces and commercial operators, will achieve considerable advancement in the art of jet engine maintenance prior to 1960. Training programs will be in effect for commercial operators in the immediate future. All of these factors will tend to facilitate inauguration of scheduled airline operations with the Convair 880.



CONVAIR

Traveler

VOLUME IX

NUMBER 7

DECEMBER 1957



the 880 WING

CONVAIR *Traveler*

VOLUME IX

NUMBER 7

DECEMBER 1957

Chief Engineer
R. L. Bayless

Manager of Service
J. J. Alkazin

Chief-Service Publications
H. R. Kennedy

Chief-Transport Service
L. J. Bordelon

Editor
G. S. Hunter

Writer
Van Hedges

Art Editor
N. J. Rutherford

FOREWORD

The new Convair 880 jet transport, which two years from now will be transporting airline passengers at speeds in excess of 600 mph, is designed to withstand the many loads subjected to it, with a safety factor to spare.

All the knowledge of fail-safe construction and fatigue-resistant design which Convair has gained from 34 years of building military and commercial aircraft is now being applied to the "880."

When the first of these sleek transports goes into service late in 1959, the Convair 880 will not only be known as the world's fastest commercial jet transport, but will justify a companion reputation as the world's safest airplane.

The basis for structural integrity of the wing and the constant testing to bring it about are discussed in this issue. A forthcoming issue will discuss fuselage structure.

ON THE COVER

Designed to incorporate the ultimate in structural integrity, the Convair 880 wing, depicted in Artist Bob Sherman's cover, represents another important reason why the new transport will occupy a leading role in the commercial jet age just ahead.



Copyright 1957

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of Convair-Liner operation and service published monthly by the Service Publications Section of Convair in the interest of Convair-Liner operators. Communications should be addressed to Manager of Service, Convair, San Diego 12, Calif.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without specific approval of their cognizant organization.



STRUCTURAL INTEGRITY of the CONVAIR 880 WING

"Built-in safety" is one of the most important factors in the design and subsequent operation of an airplane. Configuration, speed, comfort, and ease of maintenance all contribute to saleability, performance, and acceptance of an airplane, but without assured structural safety, it may as well remain in the planning stage.

A fail-safe design is one that will allow surrounding structure to assume the load of a failed member in the event that fatigue failure or other failure takes place.

Fatigue failure is the reaction of metals to repetitive stress. For example, fatigue failure is experienced any time a wire is bent back and forth in an effort to break it in two. If a load, which induces tension stress, is repeatedly applied, failure will occur at considerably less than the ultimate strength of the material. The higher the applied load, the fewer times it can be applied before the material will fail.

In the design of the Convair 880 jet transport, scheduled for delivery in 1959, Convair has incorporated fail-safe and fatigue-resistant features on a scale unparalleled in the history of aircraft manufacture. These features are based on the concept of "co-existence" of all structural members; thus should any single unit fail, structural integrity is not jeopardized.

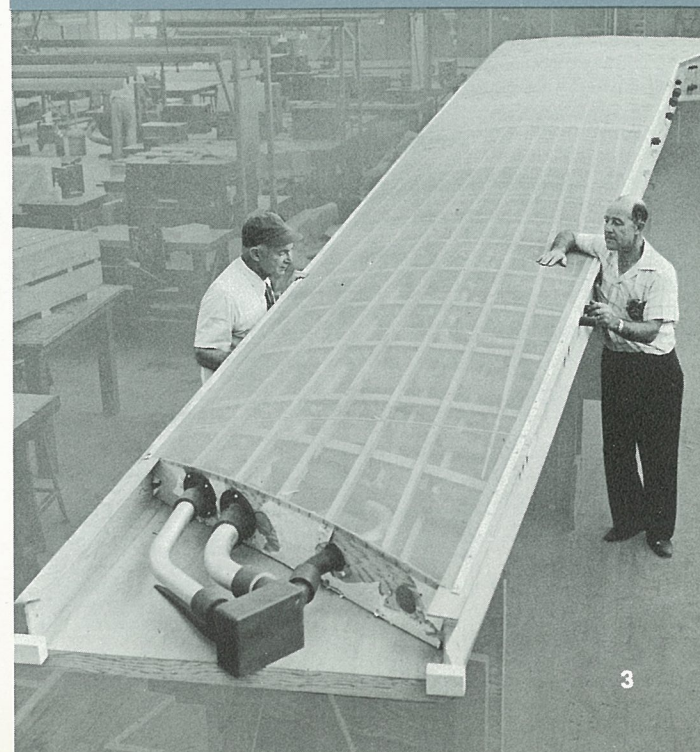
The "880" wing is a culmination of all the features of the Convair-Liners and F-102 Interceptor, plus the increased knowledge gained through the most extensive testing of complete wings ever undertaken by an aircraft manufacturer. The details of design, such as rivet patterns, splices, and access doors, reflect the knowledge gained from extensive wing panel fatigue tests conducted by Convair during the past several years. These tests of actual structural assemblies fur-

nished information concerning the interaction of structural elements—information that cannot be obtained from tests of smaller components.

Because the Convair 880 wing follows the general design plan of its predecessors—the Convair-Liners and the F-102 Interceptor—design improvements developed during the many test programs on these airplanes have been transmitted directly to the new airplane.

In one of these tests, a Convair-Liner wing panel, being static-tested at the end of the long fatigue testing program, withstood more than the required fail-safe load, with nearly one-third of the lower

Full-scale structural mockup of wing box section provides pattern for "880" wing fabrication.



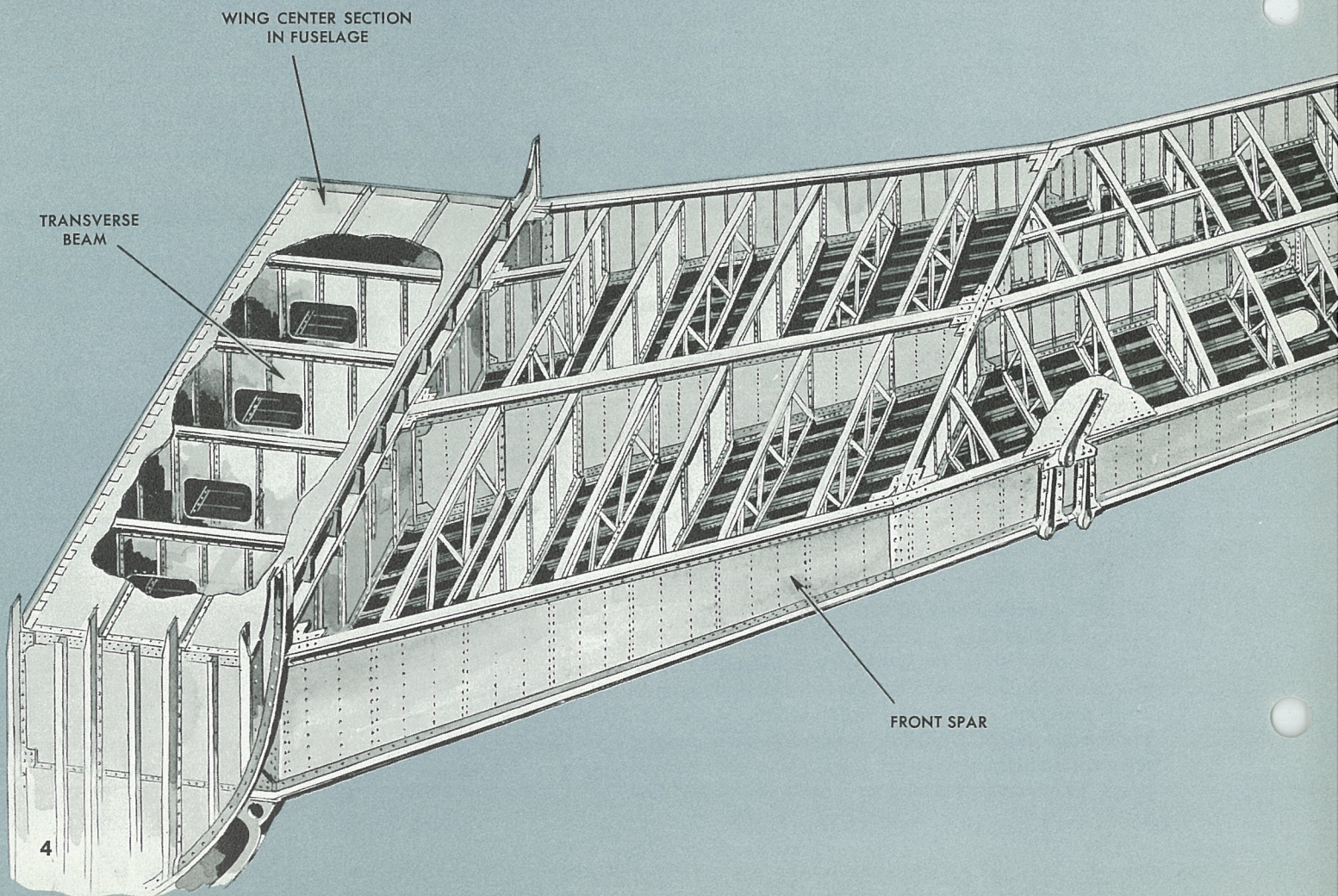
surface cracked through. In other tests, stringers and spar rails, sawed part way through in advance, were induced to fail under loads up to 71 per cent of ultimate design without producing failure of skin, spar webs, or other structure. Since the "880" wing follows the general design plan of other Convair aircraft, design improvements developed during these wing test programs will be incorporated in the "880" design.

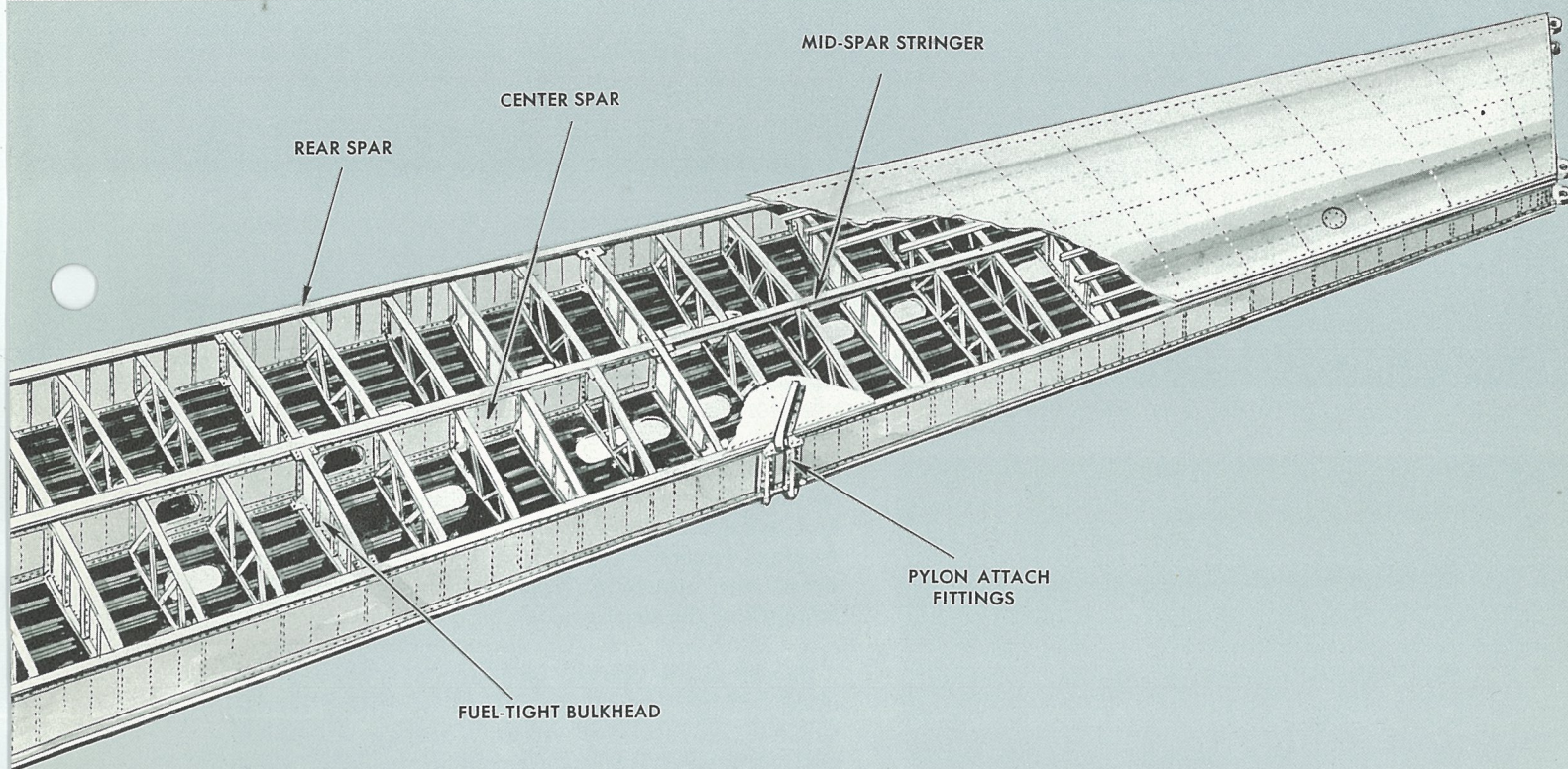
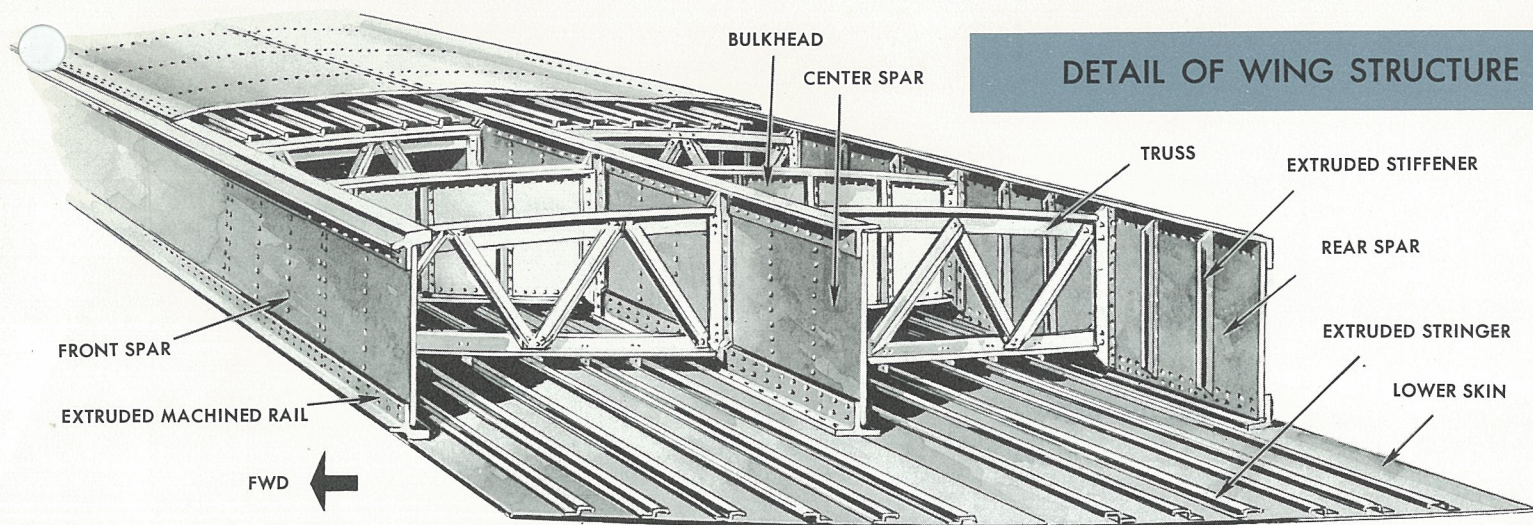
The primary wing structure of the Convair 880 is a box beam consisting of spars, plating, and stringers, similar to the type used on current Convair aircraft. This arrangement distributes the structural load among many relatively small members, minimizing the importance of each.

The "box section" wing incorporates three built-up type spars, plate-stringer skin panels, and built-up bulkheads. The spars have extruded machined rails, extruded stiffeners, and roll-tapered webs. They are assembled with rivets, and a special Scotchweld bonding method is used in the faying surfaces of all parts.

From the fuselage to a point outboard of the outboard engine, a three-spar arrangement is utilized . . . front, center, and rear spars. The purpose of the three-spar arrangement is to provide a fail-safe structure in the event any one of the three spars should fail. The center spar in the thin "880" wing provides intermediate support for wing bulkheads. Outboard of the outer engine, only front and rear spars are used. In this area, trailing and leading edges are designed to provide a fail-safe structure.

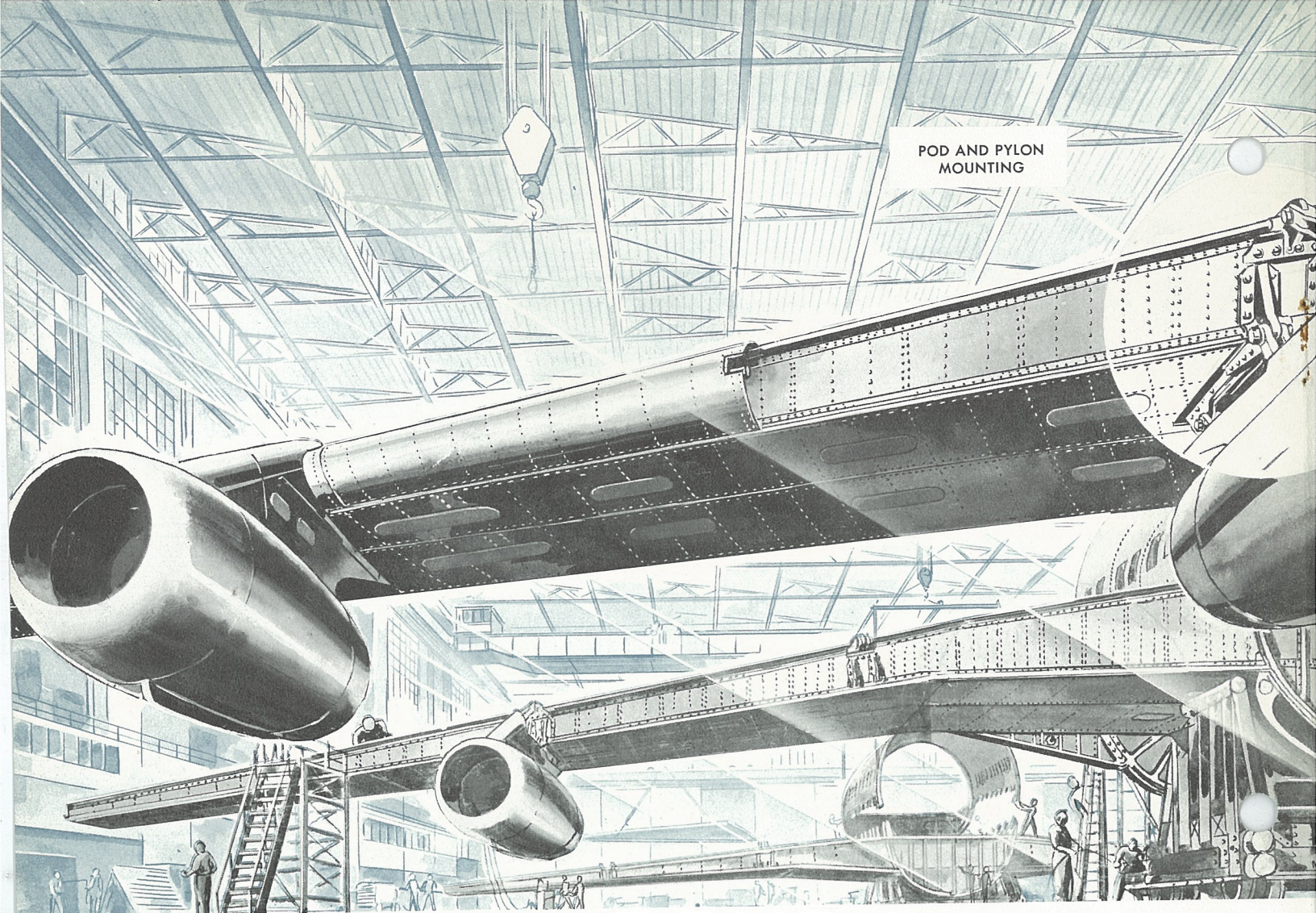
BASIC "880" WING STRUCTURE





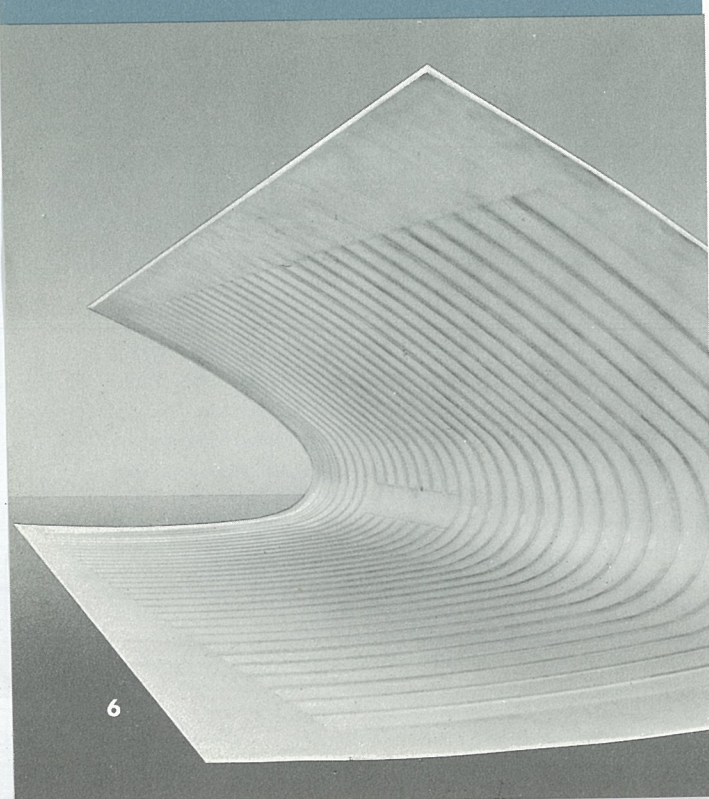
Stringers and upper spar caps are of 7178-T6, except for the front spar rail, which is of 2024-T4. This material was chosen for the front spar rail because contour of the wing provides relatively low front-spar stresses, and ductility of the material affords good resistance to forward-acting fuel loads in the integral tanks, in the event of sudden deceleration.

In addition to the three main spars in the wing, an auxiliary spar is used for support of the main landing gear. The auxiliary spar is supported jointly by the fuselage and wing structures. Detail design of the local structure is intended to permit the landing gear to break free of the wing without rupturing the fuel tanks in event of a crash landing. It is intended also that the pods and pylons break free of the wing without rupturing the fuel tank in a crash landing.



POD AND PYLON
MOUNTING

Wing leading edge skin is dynamically etched to provide channels for anti-icing heat.

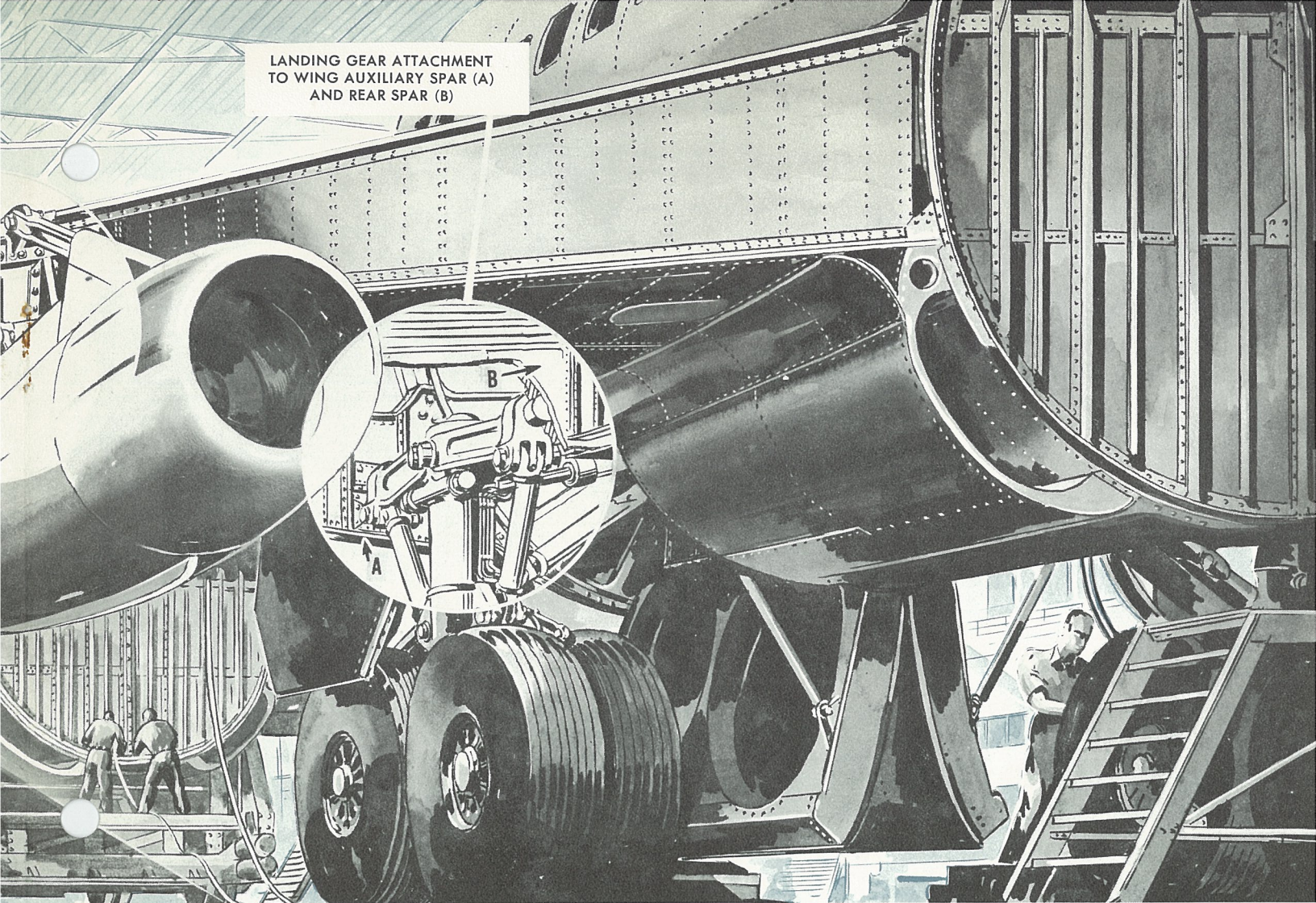


The wing center section beneath the fuselage incorporates four transverse beams between the front and rear spars. Each of these beams is bolted to the fuselage frames. Failure of any one of these beams or of the attaching frames will not jeopardize strength of the structure.

Splices in the Convair 880 wing have been developed through knowledge gained in cycling of the Convair 240 and 340 wings. Through additional cycling tests, each splice element in the "880" wing will be proved, thus insuring that all stringer ends, doors, doublers, and splice members will give long service life.

All wing bulkheads are of conventional web stiffener of truss type construction.

Skins on the upper and lower wing surfaces of the "880" are of heavier aluminum alloy than are those utilized on Convair-Liners. The high compression yield of 7075 aluminum alloy makes it suitable for the wing upper surface, where fatigue is not critical; the lower surface utilizes 2024, where fatigue is the primary consideration.



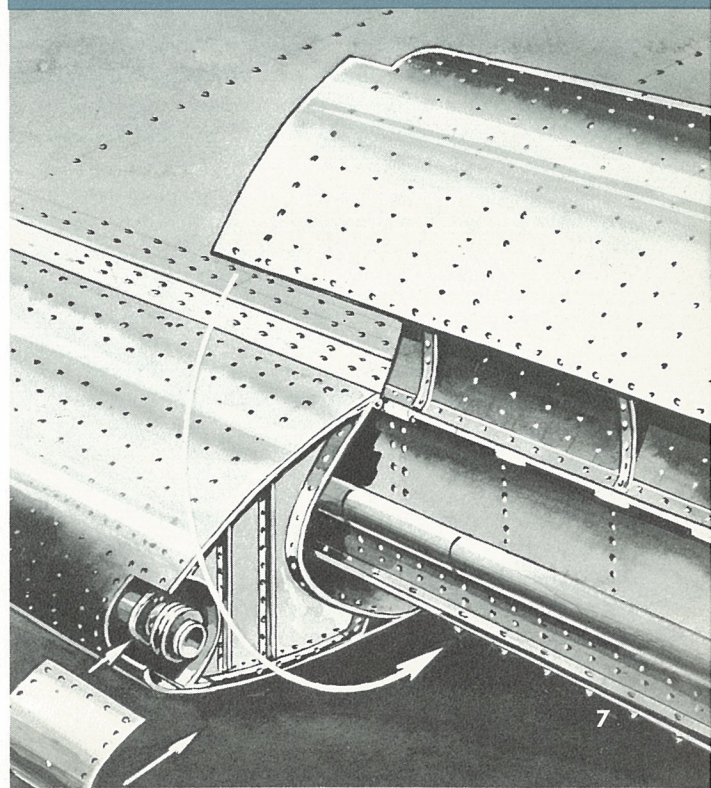
LANDING GEAR ATTACHMENT
TO WING AUXILIARY SPAR (A)
AND REAR SPAR (B)

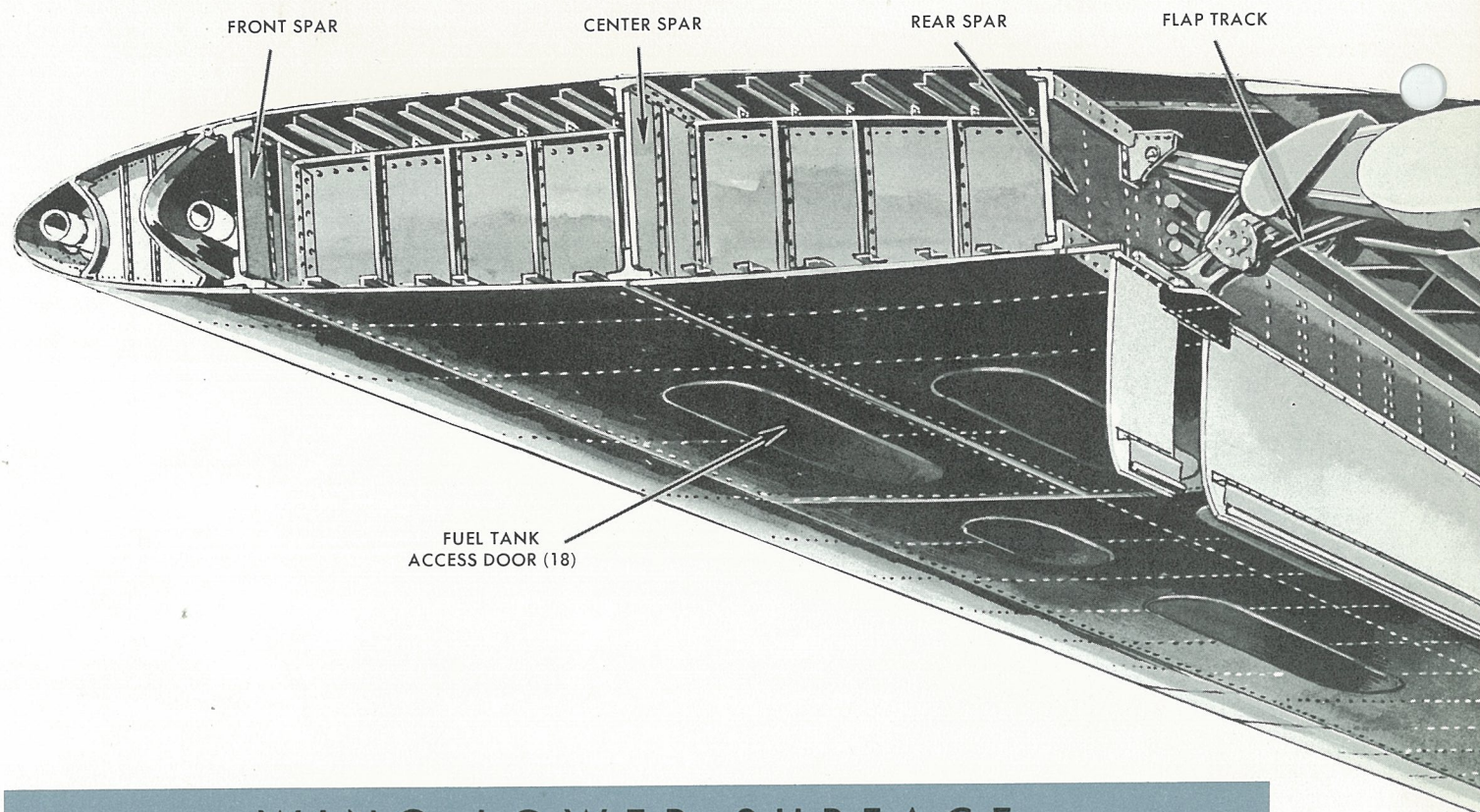
The skin on both surfaces is roll-tapered, varying in thickness, spanwise. This roll-taper provides the necessary structural strength at minimum weight in areas where it is needed. Extruded stringers are used on upper and lower surfaces.

The leading edges of the "880" wing are unique in structure and in the ability to provide anti-icing protection. There are two thicknesses of skin — a heavy gauge outer skin and a thin gauge inner skin. The outer skin, formed from material of approximately .100 inch thickness, is dynamically etched, after forming, to provide recesses approximately two inches wide and from .04 to .08 inch deep, chordwise around the leading edge. These recesses are separated by raised lands, $\frac{3}{8}$ inch wide. The inner skin is wrapped inside the outer skin and the two are riveted together. The lands between recesses provide for attachment of the inner skin and nose ribs.

Heat, in the form of bleed air from the engine compressor, is fed into the channels, which are formed by the lands, through titanium tubes. The result is an almost perfect heat exchanger that has

Leading edge sections from outboard engine to fuselage are hinged for quick easy access.





WING LOWER SURFACE SHOWING ACCESSIBILITY

proved 85 to 90 per cent efficient. Under limit cruise load tests, no wrinkles appeared on the leading edge structure, and a perfectly smooth surface was maintained up to design limit load.

The trailing edge, flaps, ailerons, and spoilers are of bonded honeycomb construction, developed to decrease the fatigue effects of sonic vibrations. This structure was developed after extensive testing in the facilities maintained by the test lab at Convair.

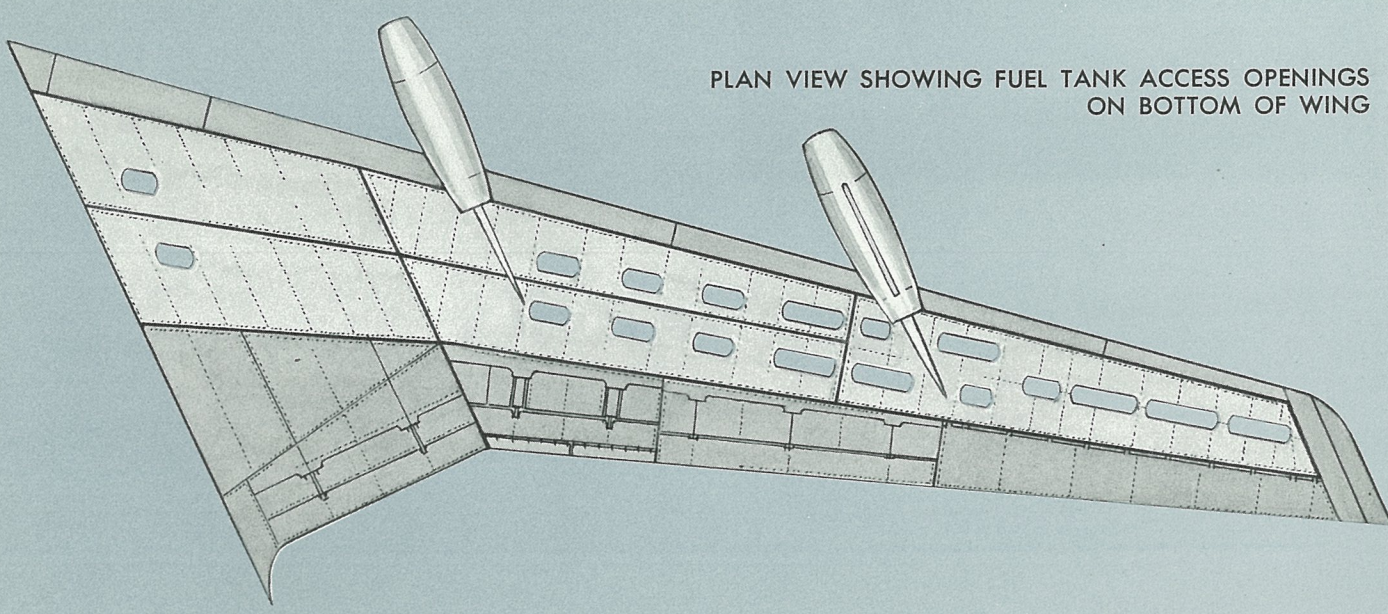
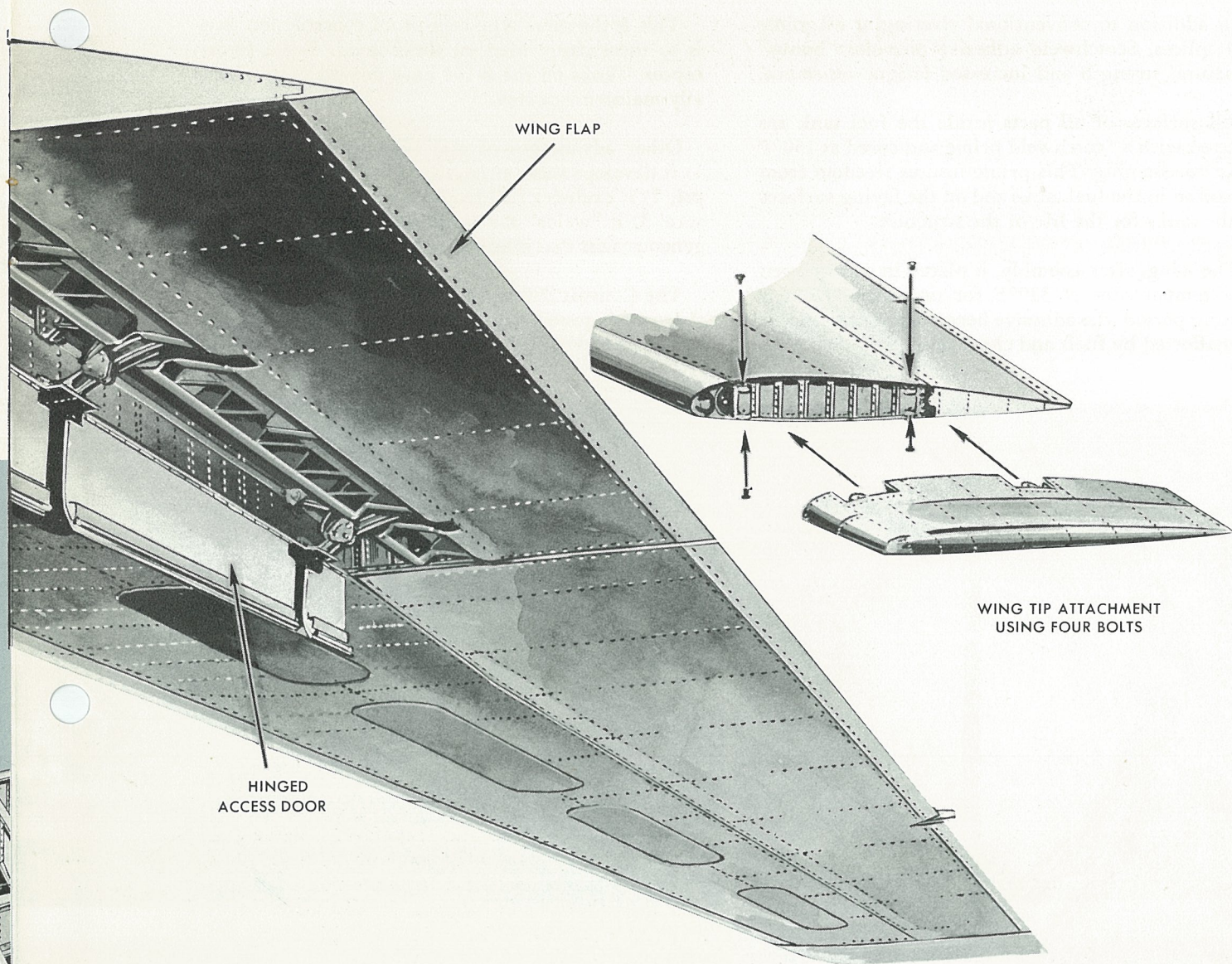
A siren for developing pressure impulses was used for development work on the honeycomb panels. The siren operates on the principle of compressed air passed through a plenum chamber to a siren motor, which converts compressed air power to sound power. From this stage, the sound is propagated by means of an acoustic matching horn, and then piped through a sonic tunnel. Power for the test program is provided by a 140-hp industrial engine driving an Allison supercharger turbine.

The test acoustic pressures generated by the siren result in 400 pounds or more dynamic drive over a test panel 22" x 44". These are accelerated test conditions and greatly exceed the sound pressures expected for Convair 880 operations.

Considerable attention has been given to accessibility for maintenance and inspection purposes. A full-size mockup of the wing was built for the express purpose of working out a combination of access doors, hand holes, and locations for equipment, so as to provide maximum accessibility with minimum effort.

The entire lower surface, forward of the flaps and aft of the fuel tank, is hinged to give access to equipment located along the rear spar. The leading edges from the outboard engine to the fuselage are hinged for quick, easy access and to prevent damage to leading edges during maintenance operations on equipment in the leading edges. The wing tips are attached with only four bolts and are easily removable.

Fail-safe design has been followed throughout the wing structural box, which incorporates the integral fuel tanks. The Scotchweld process, developed by Convair in cooperation with Minnesota Mining and Manufacturing Company, utilizes a metal-to-metal adhesive for fuel-tighting of structural members and skins in these areas.



In addition to conventional riveting at all joints and splices, Scotchweld adhesive provides "bonus" structural strength and increased fatigue resistance.

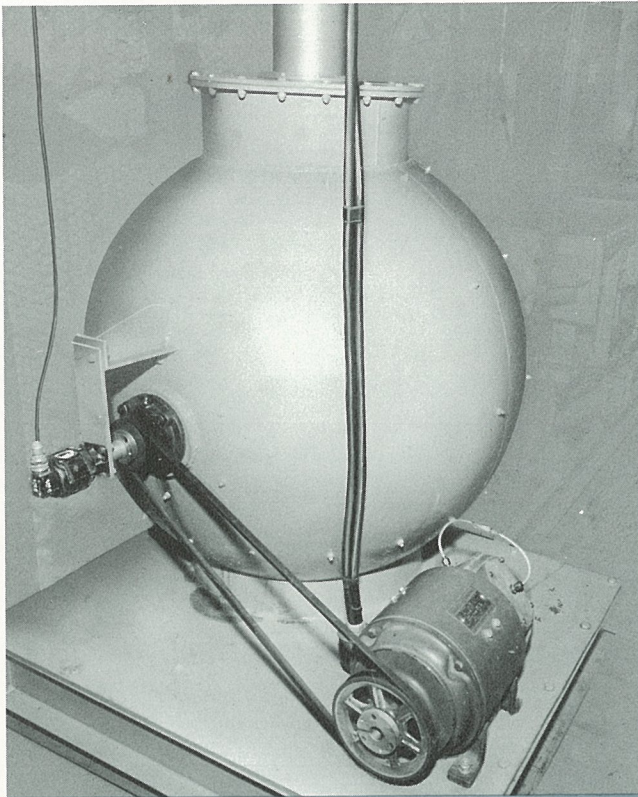
All surfaces of all parts inside the fuel tank are sprayed with a Scotchweld prime and cured at 150°F prior to assembly. This prime insures freedom from corrosion in the fuel tanks and on the faying surfaces of the tanks for the life of the structure.

The wing, after assembly, is placed in a large oven at a temperature of 320°F for one hour. After a cooling period, the adhesive becomes cured so that it is unaffected by fuels and chemicals.

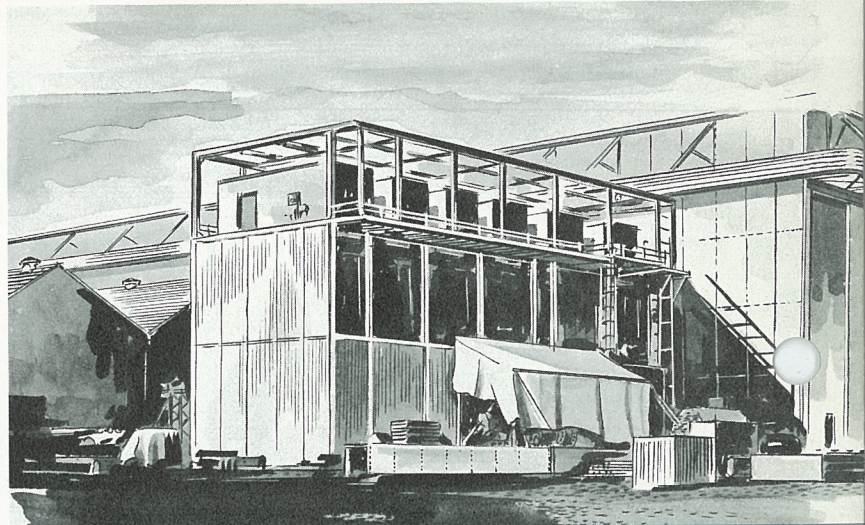
This is the same type leak-proof construction that is so successfully used on the Convair F-102 Interceptor. Tanks on the F-102 have proved to be virtually maintenance-free.

Other advantages of this type construction are: 1) it develops shear strengths of approximately 4000 psi; 2) it excludes fuel from all faying surface structure; 3) it "welds" the entire structure into a homogeneous mass that is leak-proof and maintenance-free.

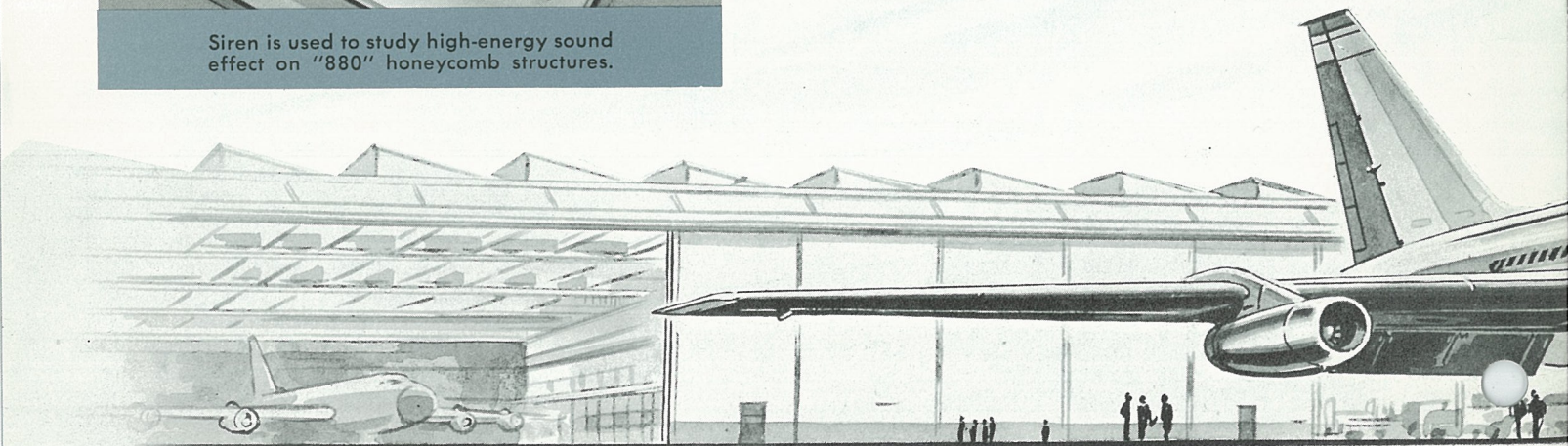
The Convair 880 wing integral fuel tank has been thoroughly tested, utilizing a full-scale section of the wing. This test specimen "wing" was a truly repre-

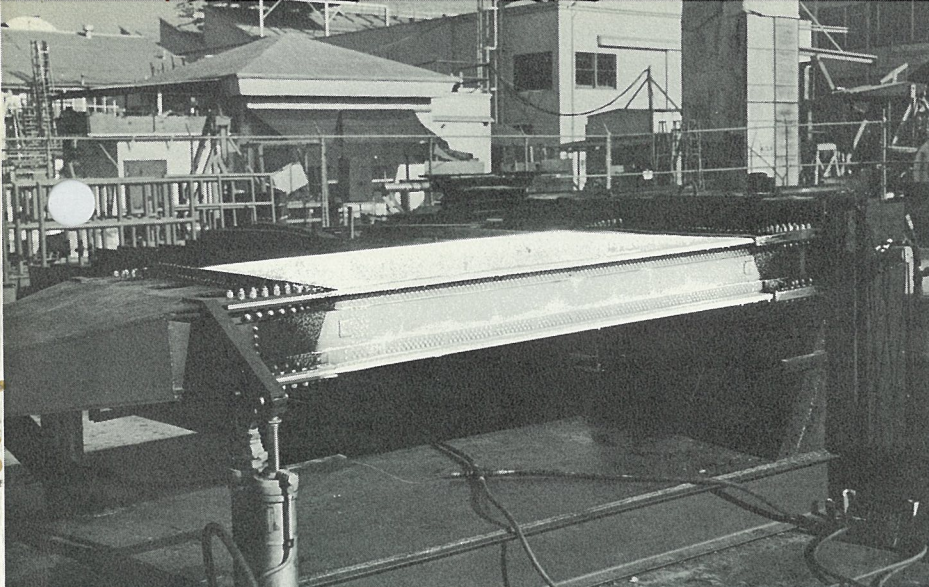


Siren is used to study high-energy sound effect on "880" honeycomb structures.

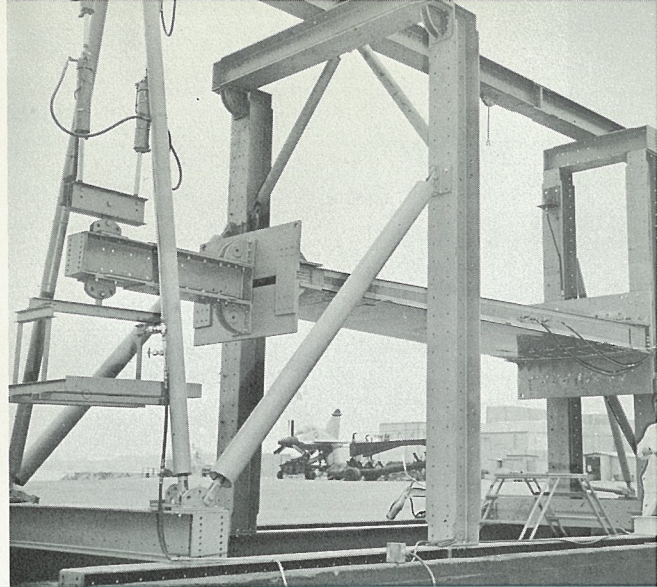


Nearing completion is Scotchweld oven used in leak-proof construction of wing fuel tanks.





Low-temperature test on wing panel produces frost and freezes fuel, but fails to create leaks.



Wing section in test facility is subjected to many loads to prove structural integrity.

sentative section of the wing, embodying all proposed fasteners, structural elements, and other details as represented in the finished wing. The purpose of building this 20-foot test tank was to prove the integrity of the fuel tank and all materials used or proposed for use in the "880" tank.

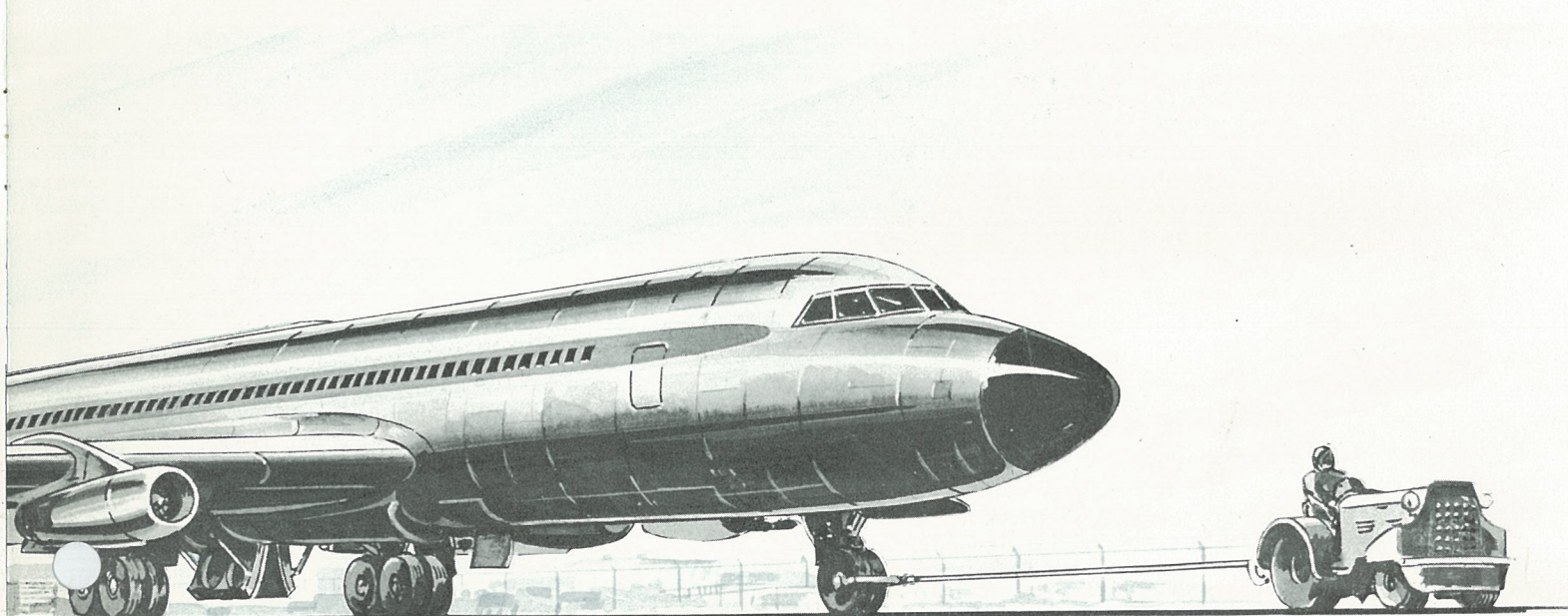
An exhaustive test program was instigated whereby a test tank was subjected to torsional, bending, and thermal stresses far in excess of expected service operating conditions. The tank, while filled with fuel and pressurized to 10 psi, was cycled through a load spectrum covering normal conditions encountered in airline operation.

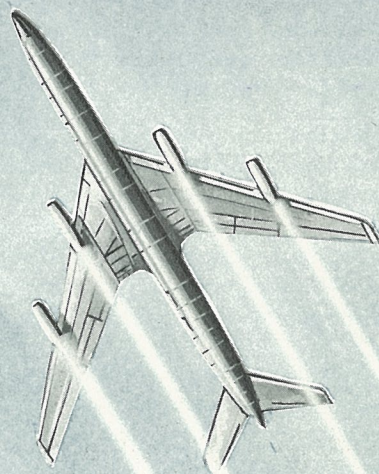
The cycling program included a phase of low and high temperatures. The low-temperature cycling occurred at temperatures of -65°F and -70°F for

a period of 48 hours. Near the conclusion of the cold tests, temperatures had to be moderated because of freezing of the fuel.

The high temperature tests followed, with temperatures ranging from 72°F (ambient) to 180°F for 48 hours. At the conclusion of this rigorous test program, the test log failed to show a single leak or even a stained rivet. No structural failure occurred and no evidence of the severity of the tests was noted.

Considerable developmental testing of the "880" wing detail has already been completed. All tension critical joints and splices are being tested and will undergo fatigue cyclic loading patterns until failure. The valuable data gained from this fatigue test program are being reflected in the final product.





34

CONVAIR

Traveler

VOLUME IX

NUMBER 1

MAY - JUNE 1957



Transports on Parade

CONVAIR *Traveler*

VOLUME IX NUMBER 1 MAY - JUNE 1957

Chief Engineer
R. L. Bayless

Manager of Service
J. J. Alkazin

Chief Service Publications
H. R. Kennedy

*Chief Service Engineering—
Transport*
L. J. Bordelon

Chief Aircraft Change Service
O. W. Harper

Editor
G. S. Hunter

Art Editor
N. J. Rutherford

FOREWORD

Since the first Convair-Liner 240 flight over ten years ago, two more versions of this popular and dependable airplane . . . the Convair-Liner 340 and Metropolitan 440 . . . have been built, and a completely new transport . . . the pure jet "880" . . . is in production.

In this combined May-June issue, we have briefly described the many versions — commercial and military — of the Convair-Liners, and we have included some of the special features of the "880."

The gate-fold map on the back cover reflects the operating bases of all Convair-Liner and 880 Jet-Liner operators.

ON THE COVER

Artist Dick Henderson displays four great aircraft . . . the familiar Convair-Liners and the new all-jet "880."



Copyright 1957

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of Convair-Liner operation and service published monthly by the Service Publications Section of Convair in the interest of Convair-Liner operators. Communications should be addressed to Manager of Service, Convair, San Diego 12, Calif.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without the specific approval of their cognizant organization.

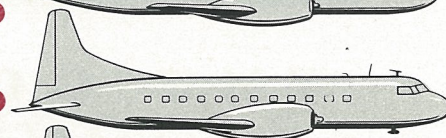
Transports on Parade

TRANSPORT AIRCRAFT PRESENTLY IN SERVICE ARE THE

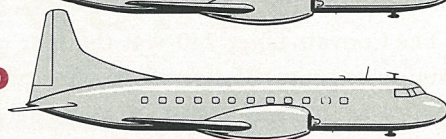
240



340



440



More than ten years and ten billion passenger miles have passed since the first Convair-Liner 240 made its initial flight. Since then, this airplane, which was designed specifically to solve the problems of short-to-medium range operation, has proved the soundness of the design by setting new and unparalleled records for safety, low operating costs, and ease of maintenance.

The success of the Convair-Liner 240 has resulted in two larger, advanced versions . . . the Convair-Liner 340 and the Metropolitan 440.

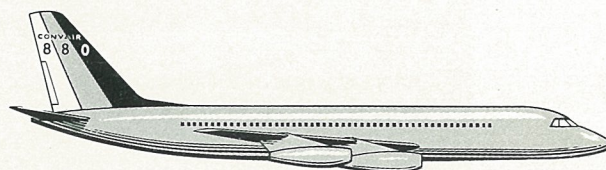
There are now some 900 of these airplanes in operation, including 10 different military versions. The military aircraft include electronic test-bed airplanes, navigator and bombardier trainers, flying ambulances, and cargo and passenger carriers. More than 20 executive versions are flying with industrial and private operators.

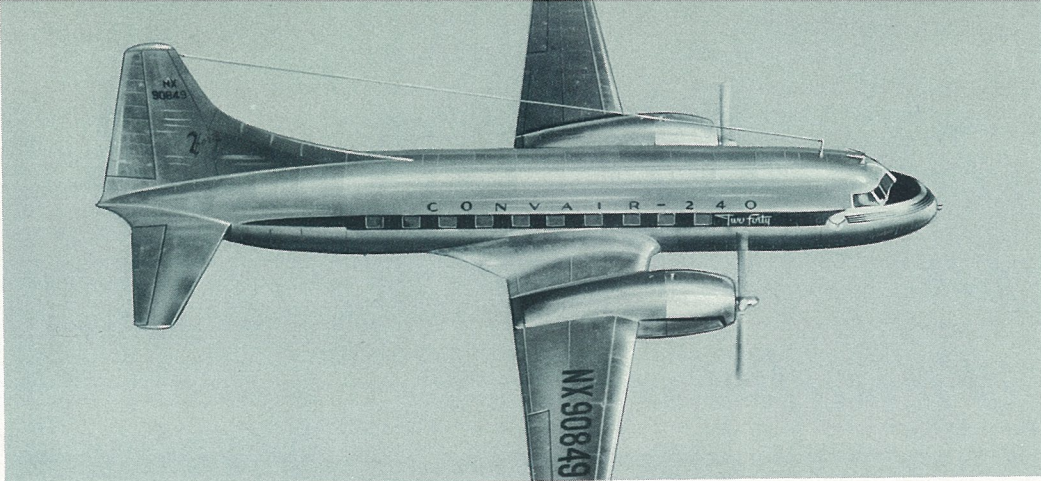
This versatility has been further expanded by the use of turboprop engines. Two military and two commercial versions have been undergoing tests for many years, and conversions are now being offered by engine manufacturers.

Convair engineers applied the knowledge gained from the performance of the Convair-Liners to the design of a completely new airplane . . . a pure-jet transport for short-to-medium range flight. This new airplane . . . the "880" . . . is scheduled for delivery in 1959.

IN PRODUCTION - THE 880

jet ^{*}Liner





THE CONVAIR-LINER

The Convair-Liner 240 was the first post-war two-engine commercial aircraft to offer pressurized cabins; to use reverse thrust; to simplify engine maintenance through the use of "orange peel" cowling; to offer integral fuel tanks and a self-contained door and stairway installation.

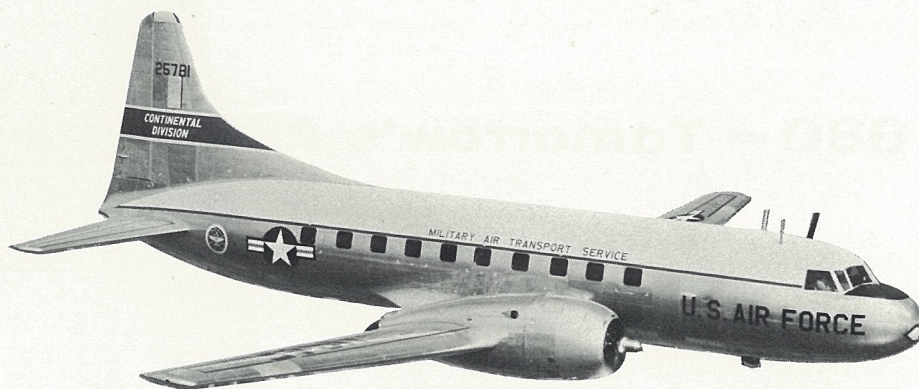
These design features were the result of combining war-born aeronautical advances, airline operating requirements, and pilot and airplane mechanic recommendations. They have proved their worth, and have been retained in the larger advanced versions of the Convair-Liner.



The Convair-Liner 340 is 54 inches longer than the Model 240, and has a greater wing span, increasing passenger capacity and allowable gross weight. The 340 has retained the excellent flight characteristics of the 240; its capabilities have been increased.

The Metropolitan 440 "Quiet-Liner" may be distinguished by rectangular exhaust silencers, part of a complete system of sound suppression. Another easily recognizable feature on some models is the streamlined radar nose, which houses the weather mapping radar.





MILITARY MODELS

Convair-Liners in several versions are being used by the Air Force and Navy as navigator and bombardier trainers; as hospital transports; as electronic test beds; as test beds for turboprop engines and propellers; and as cargo and personnel carriers.

T-29's . . . "Flying Classrooms" . . . are Convair-Liner 240's equipped with astrodomes and camera-bombsights to permit the training of several students simultaneously.

The C-131A, another version of the 240, has every facility necessary for the care and comfort of patients, during trips to base hospitals.

Air Force electronic equipment is tested on a version of the 340 . . . the C-131B. Some airplanes are equipped with underwing power pods, to provide the power necessary for the extra electronic gear.

The YC-131C is another version of the 340, and is used to test turboprop engines. The service-proved characteristics of the Convair 340 airframe made it an ideal vehicle for testing the new type engine.

Air Force C-131D's and C-131E's, and Navy R4Y's (340's and 440's) are used to transport cargo and personnel between bases overseas and in the United States.

EXECUTIVE MODELS

Private and industrial operators in increasing numbers are placing Convair-Liner executive models into service. One example is the Metropolitan 440 pictured here, which will carry the Brooklyn Dodgers Baseball Club around the playing circuits.

Private owners find that one of the major advantages of operating the Convair-Liner is the availability of world-wide service and maintenance. These aircraft are operated by commercial airlines on all six continents and on islands in the Pacific.



The 880 – Tomorrow's Airplane –

uses Today's Airports

The "880" has been designed to utilize existing airport facilities. Most ground-handling equipment presently in use will require either no change, or only minor modifications.

The short turning radius, reverse thrust, and high lift of its 2000 square foot wing will enable this new transport to operate from more than 150

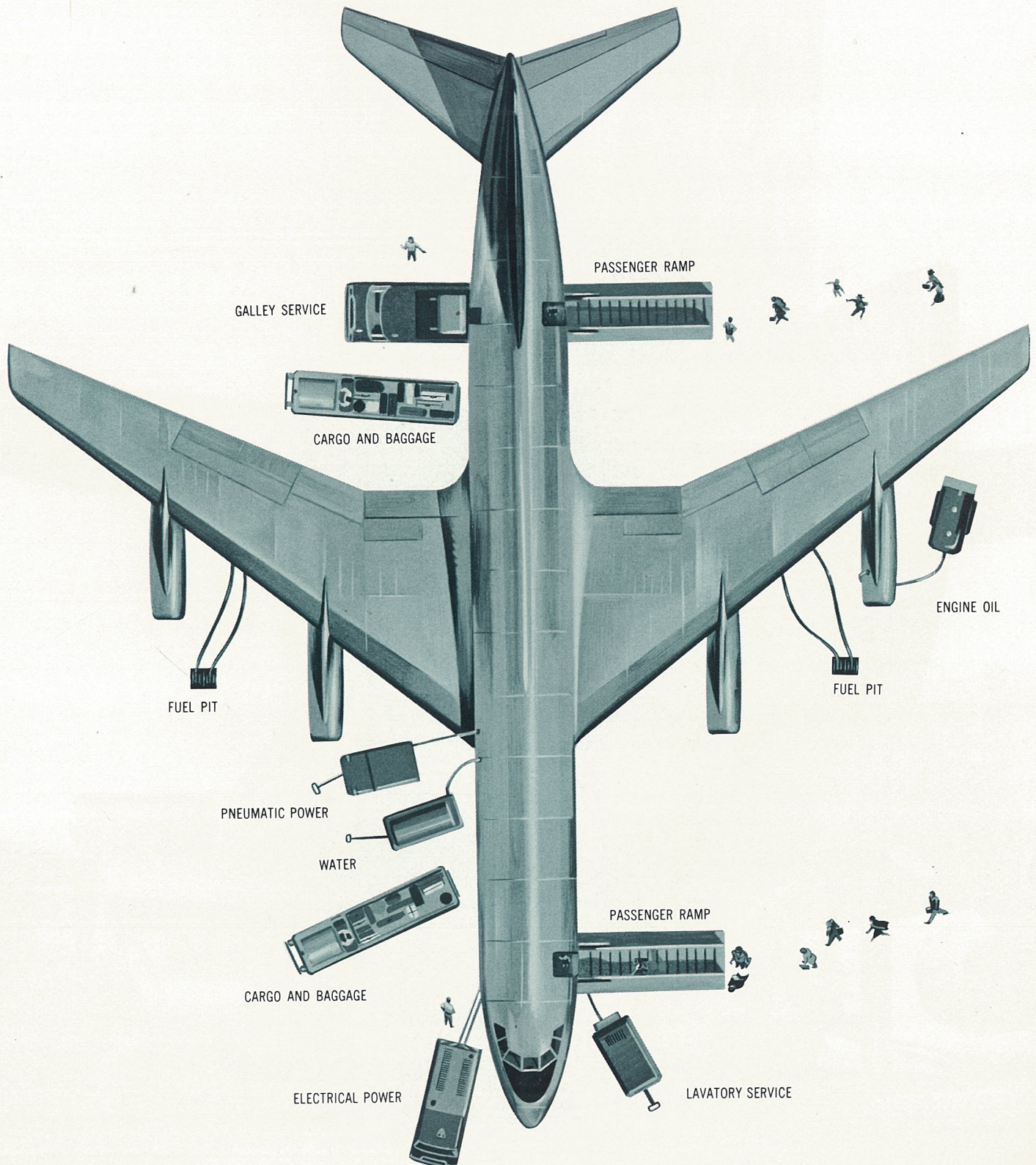
present day medium-length airports in the United States.

Future terminal facilities and requirements are being determined with the aid of a miniature airport, constructed in Convair's model shop and complete with passenger, baggage trains, food handling vehicles, ground crews, and portable blast fences.





TURNAROUND



THREE VIEW



PRINCIPAL DIMENSIONS

WING

Span — Overall.....	120 feet
Area — Total.....	2000 sq ft
Root Chord.....	35 ft 8.425 in
Tip Chord.....	6 ft 9.1 in
Dihedral.....	7°
Aspect Ratio.....	7
Sweepback (30% C).....	35°
M.A.C. (true).....	18 ft 11.3 in
Flaps — Type.....	Double-slotted

TAIL

HORIZONTAL

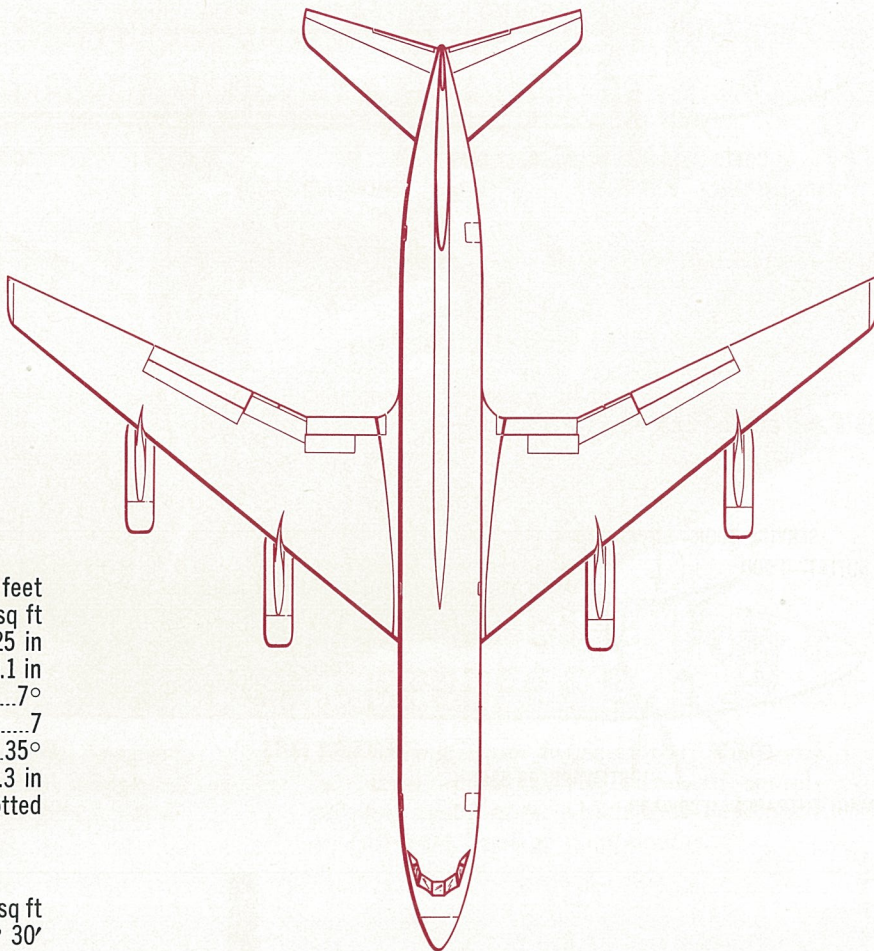
Area.....	395 sq ft
Dihedral.....	7° 30'
Sweepback (30% C).....	35°

VERTICAL

Area.....	295 sq ft
Sweepback (30% C).....	35°
Top of Fin from Ground.....	36 ft 0.3 in

FUSELAGE

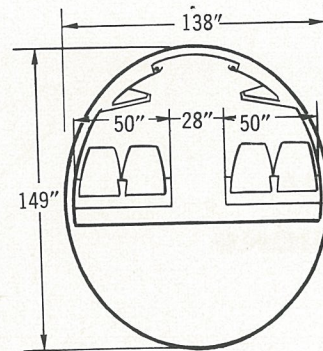
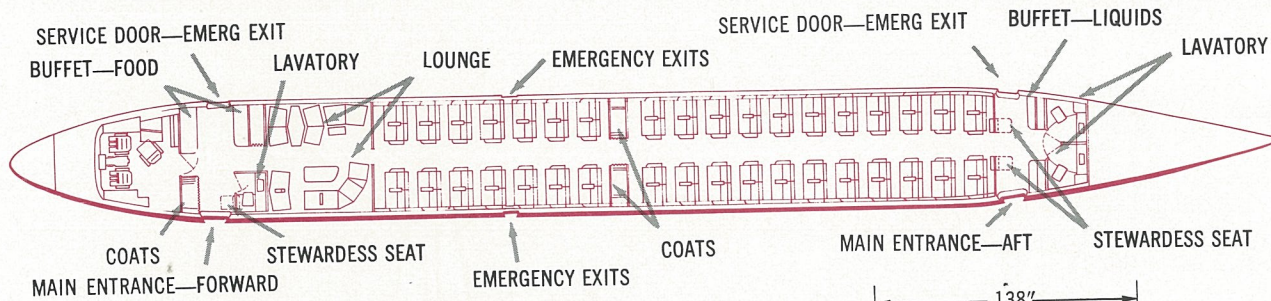
Width (maximum).....	11 ft 6 in
Height (maximum).....	12 ft 5 in
Length.....	124 ft 2 in



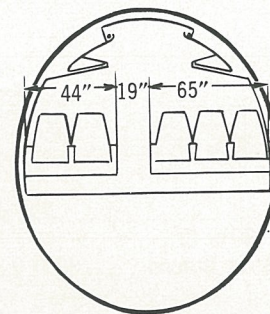
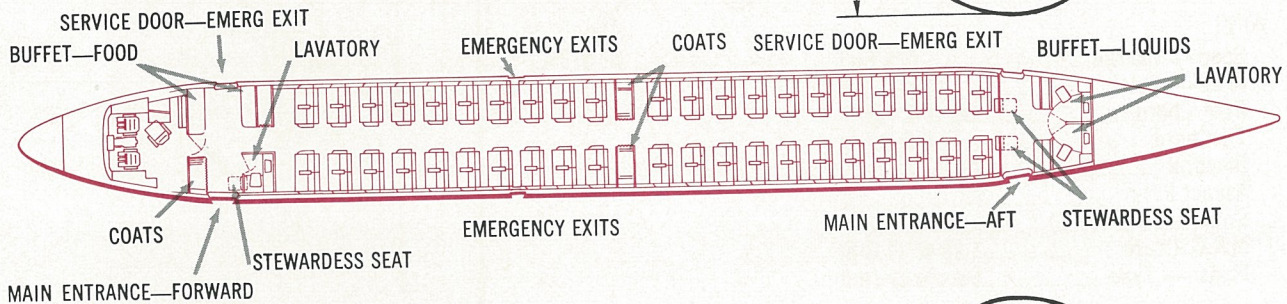
SEATING ARRANGEMENTS

STANDARD SEATING

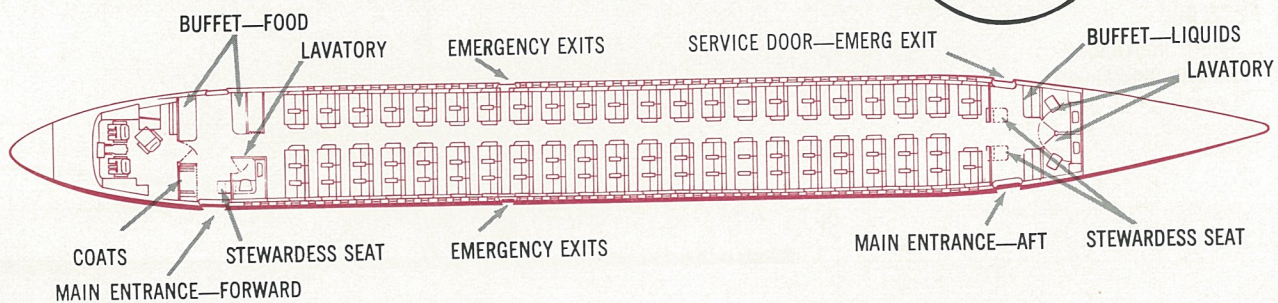
(LOUNGE VERSION)



STANDARD SEATING



COACH SEATING

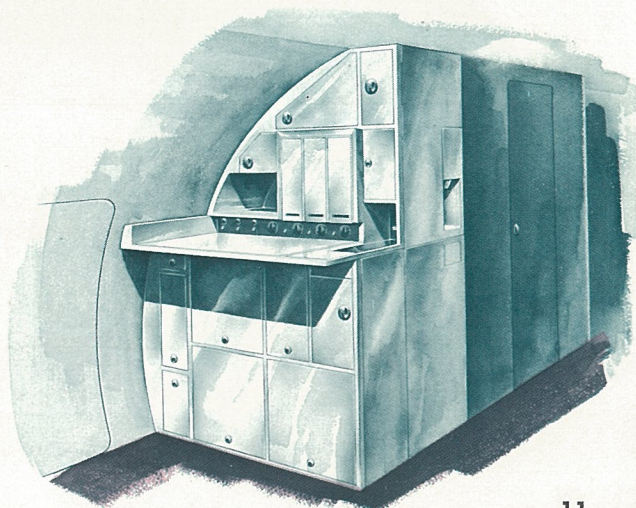


I N T E R I O R S

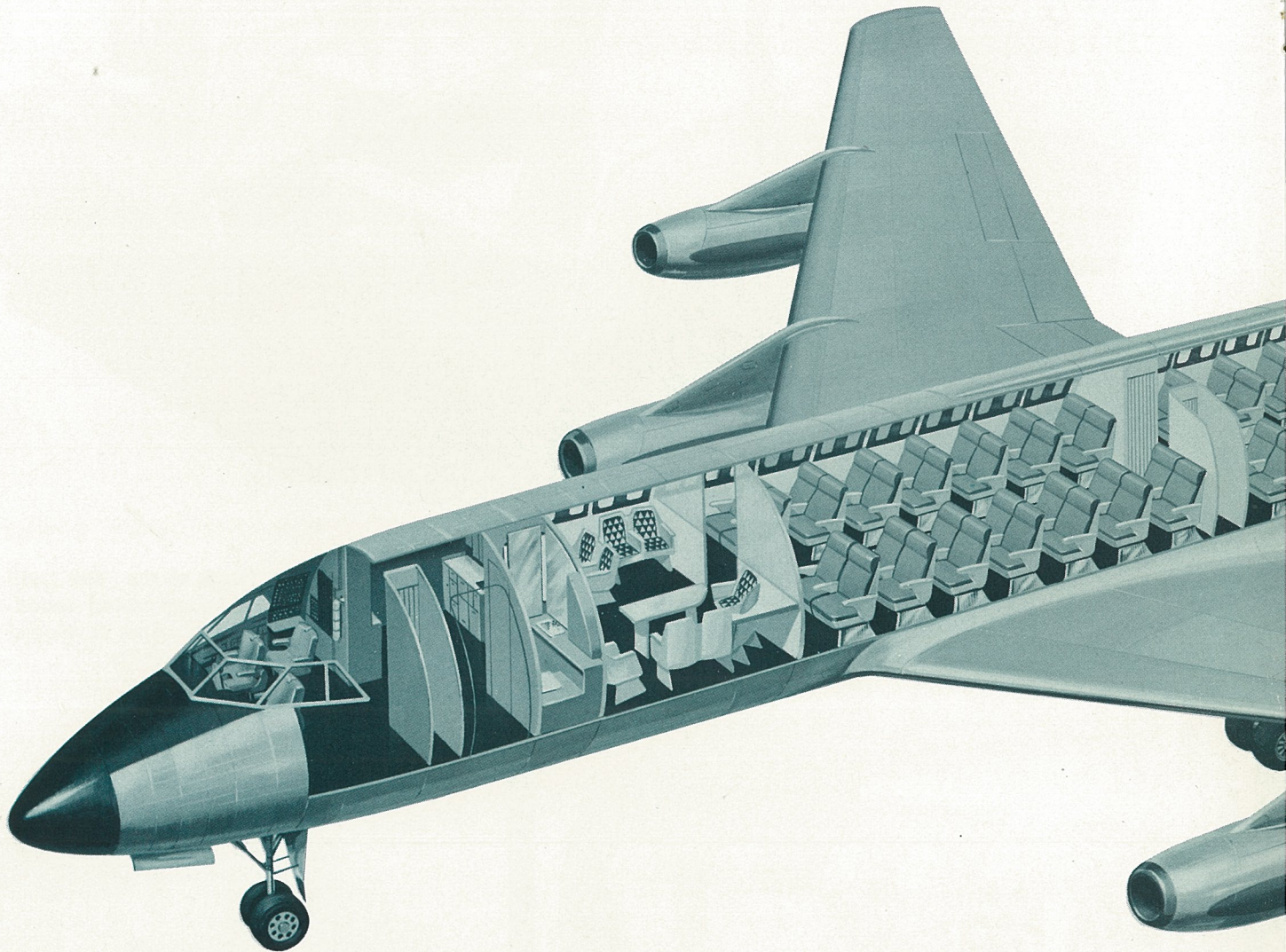


Interiors of the new "880" jet-liner, designed by nationally-known industrial designers and stylists, will afford passengers a maximum in comfort and luxury.

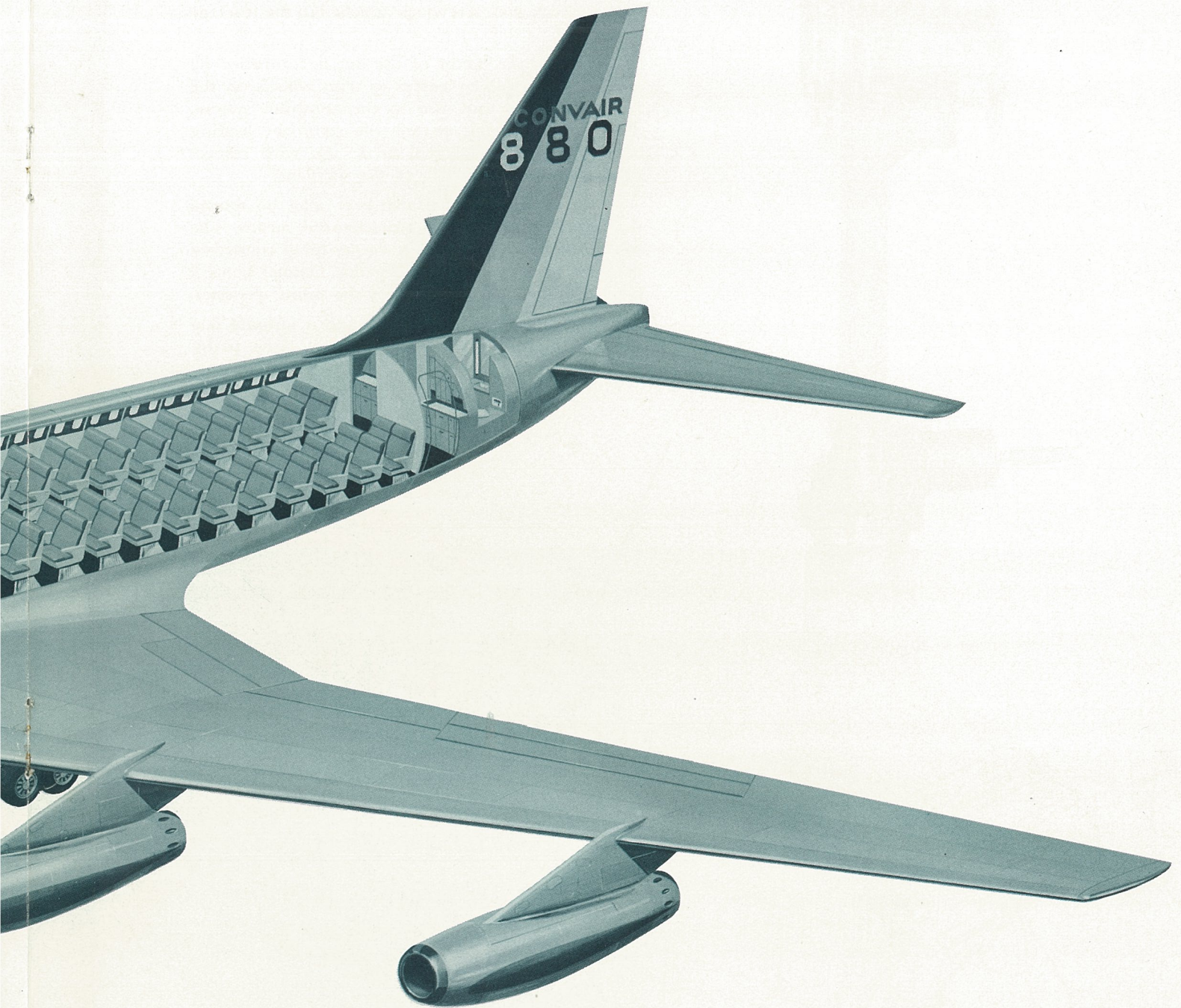
The smooth, quiet flight of the "880" will be further enhanced by advanced sound-proofing techniques, which were developed on full-scale fuselage components.



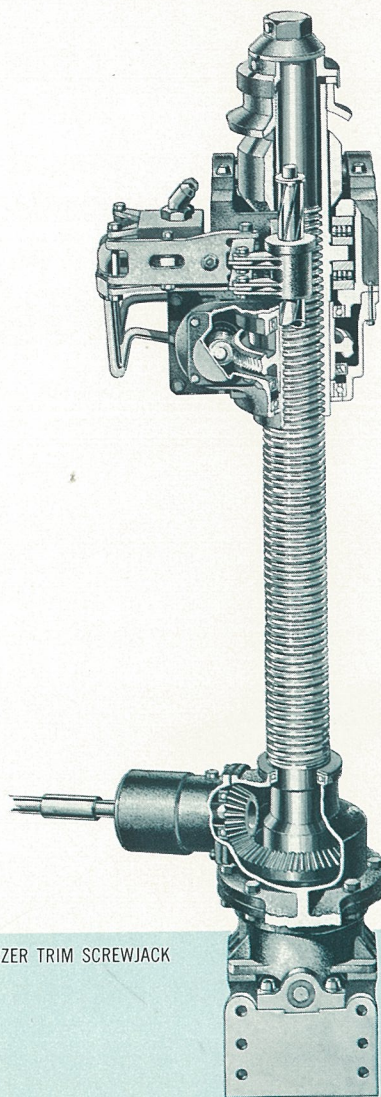
THE 880 JET-LINER



GENERAL ARRANGEMENT



STABILIZER CONTROLS



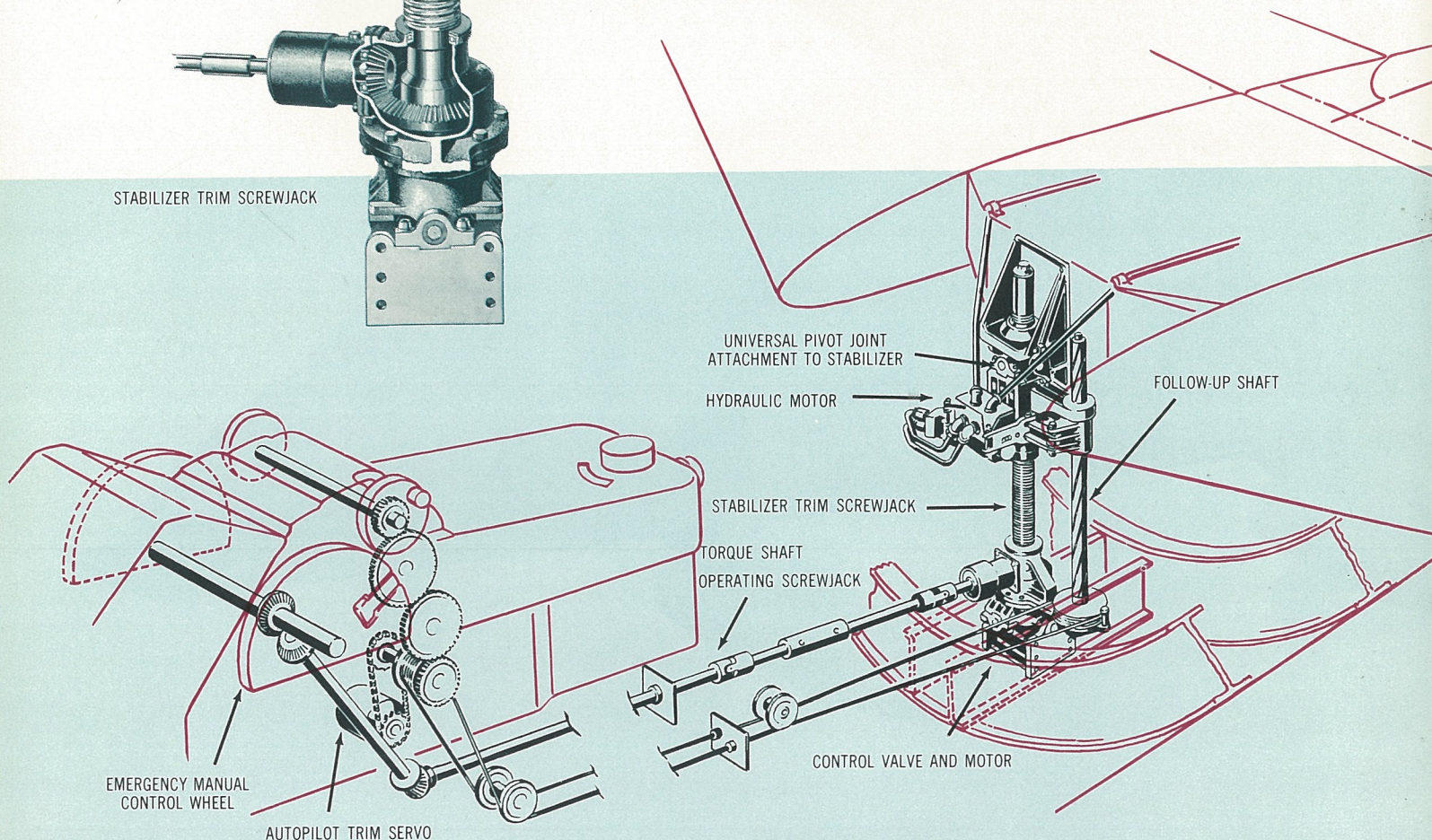
STABILIZER TRIM SCREWJACK

An interesting feature of the "880" flight control system is the single all-movable horizontal stabilizer. The stabilizer is actuated by a hydraulically-powered nut, mounted on the forward part of the stabilizer. The nut engages a screwjack attached to the fuselage frame.

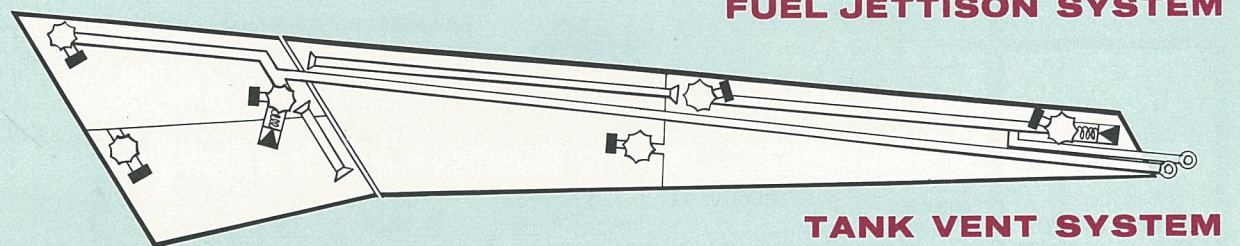
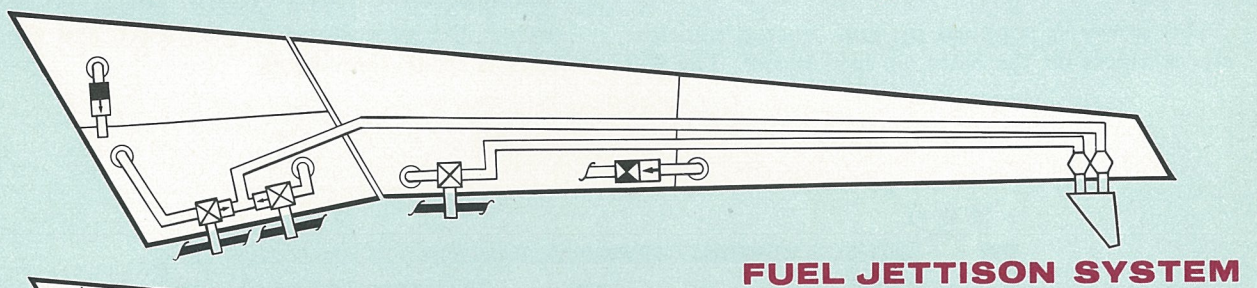
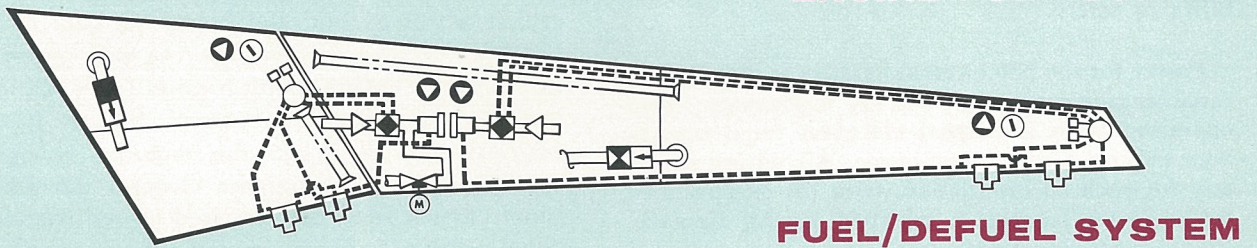
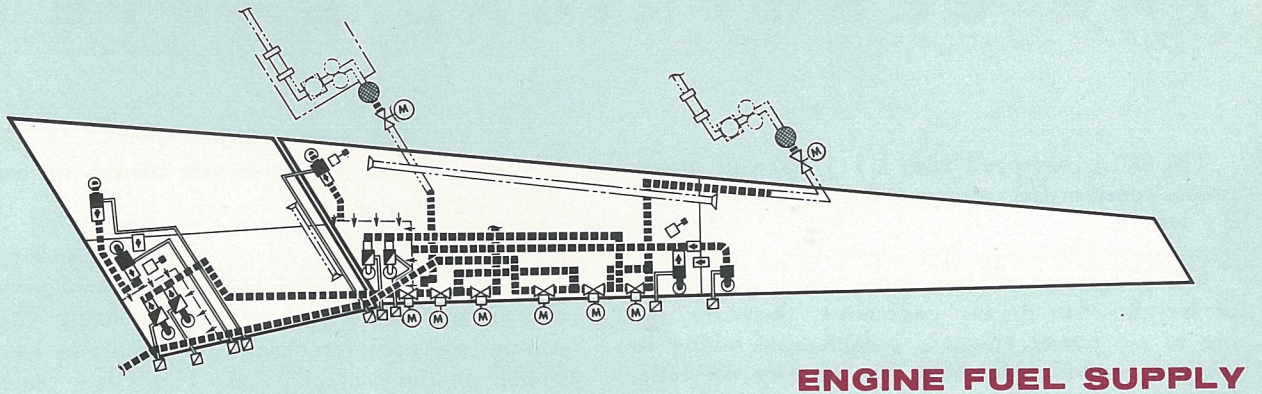
The hydraulic motor of the nut is controlled by a valve connected by cables to trim wheels on the pilots' pedestal, and also to the autopilot system. The motor and nut permit the stabilizer leading edge to travel 14° down, or 2° up, with respect to the longitudinal axis of the airplane.

In an emergency, the stabilizer may be moved through this arc by direct mechanical means. The screwjack can be turned by torque tubes connected through bevel gears to emergency manual control wheels located on each side of the pilots' pedestal.

Both systems are irreversible, and a fail-safe feature is achieved by the two individual drive paths.



ENGINE FUEL SYSTEM



- ↑—↑— Baffle with Check Valves
- ⊐ ⊑ ⊒ Bellmouth
- ▣ Booster Pump
- ▢ Check Valve
- ▣▣▣▣ Engine Fuel Supply Lines
- ▣ Float Switch
- ⊐ Flowmeter (Mass-Measuring Type)
- ▣ Fuel Control
- ▢ Fuel Flow and Pressure Regulator
- ▢ Fuel Lines
- ⊐ Fuel Pump (Engine-Driven)
- ⊐ Fuel Screen
- ⊐ Gravity Refueling Fitting
- ⊐ Grounding Provision
- ▢ Hydraulic Lines
- ▣ Jettison Pump (Hydraulic Motor-Driven)

- ▢ Jettison Nozzle
- ▢ Pilot Control Line
- ▢ Pressure Refueling Adapter
- ▢ Pressure Relief Valve
- ▢ Pressure Switch
- ⊐ Refueling Shutoff Pilot Valve
- ▢ Refueling Shutoff Valve
- ▢ Refueling Shutoff Valve Solenoid (NC)
- ⊐ Shutoff Valve (Motorized)
- ⊐ Shutoff Valve, Plug-in Type (Motorized)
- ⊐ Shutoff Valve (Pressure-Operated)
- ⊐ Tank Vent Valve (Float Actuated)
- ⊐ Tank Vent Outlet
- ▢ Transfer Pump (Single Inlet)
- ▢ Transfer Pump (Double Inlet)

THE ELECTRICAL SYSTEM

The 880 is equipped with a 115/200 volt, three-phase, constant-frequency a-c system, and a 28-volt d-c system.

A-C generators produce more power per pound of weight than do d-c generators; therefore, the use of a-c power effects a considerable saving in weight, without imposing any penalty on reliability or safety.

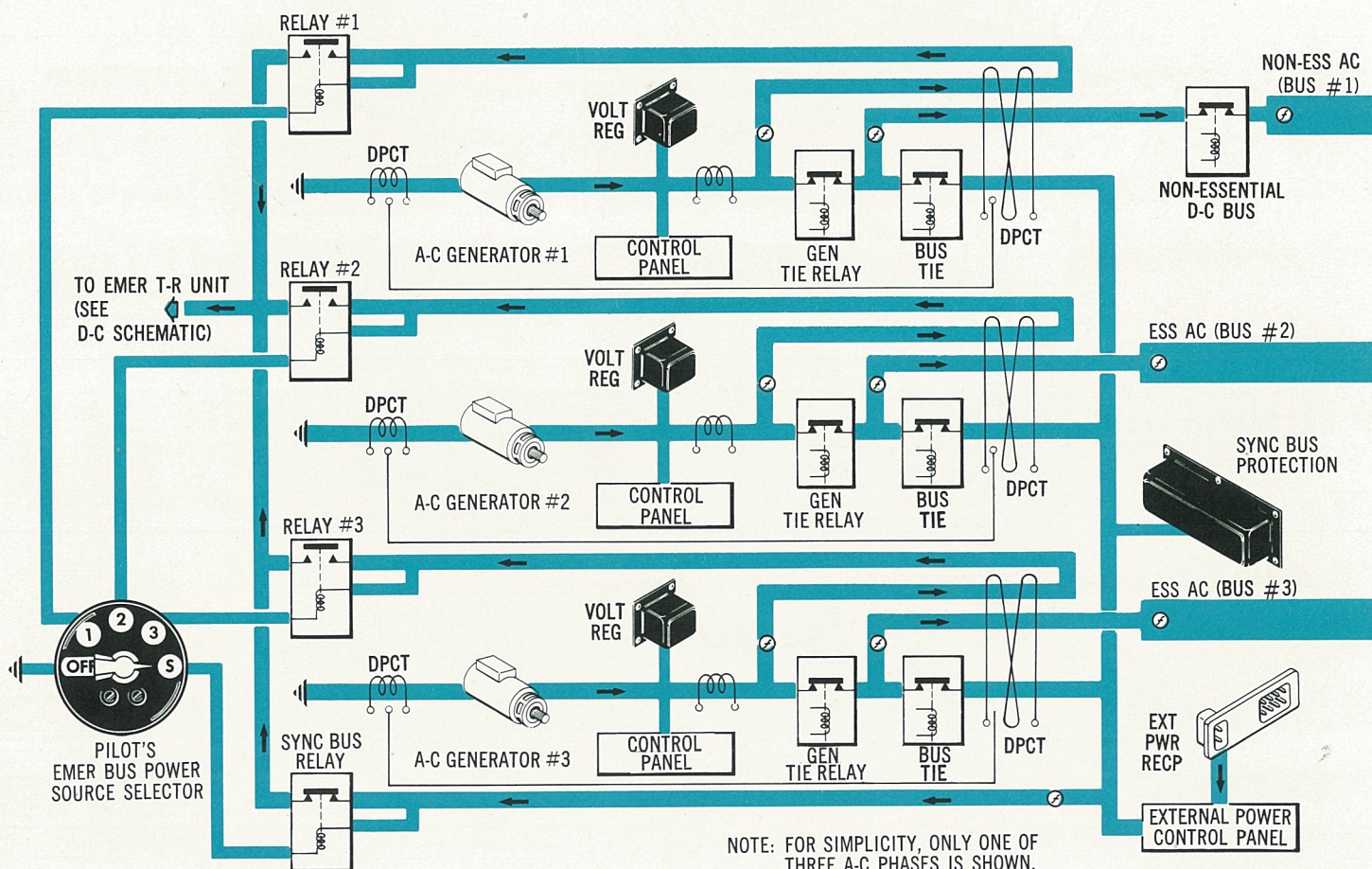
Power for the 880 electrical system is supplied by three engine-mounted, 40-KVA alternators. Some operators, with additional electrical requirements, may require a fourth generator. All wiring necessary for such an installation, with the exception of main power feeders, is installed in the airplane.

D-C power is supplied by four 50-amp transformer-rectifiers on the main a-c load busses. The 880

is also equipped with a 24-volt battery for emergency power.

A-C SYSTEM OPERATION. In order to prepare the aircraft for generator power during engine run-up, the operator closes each generator control switch on the control panel. This closes the field circuit of the exciter, and causes the generator to build up to required voltage. As each generator builds up, its bus-tie circuit breaker is automatically opened, and the generator circuit breaker is automatically closed. When the required voltage is reached, the flight engineer changes the ground power switch from the "external power" setting to "auto-parallel." Then, ground power is disconnected, the generators are paralleled, and the aircraft is ready for takeoff.

A-C SYSTEM



When the flight is complete, and all engines shut down, the generator circuit breakers are automatically tripped by an under-speed relay. The bus tie circuit breakers are closed, and all load busses become energized by ground power when it is attached to the system.

In the event that one of the generators exhibits a fault during flight, the control system automatically removes the faulty generator from the line. Generator failure is indicated by a warning light on the control panel.

When the generator fault indicator light flashes in the cockpit, the flight engineer resets his selector switch to transfer the complete load to the two undamaged generators.

D-C SYSTEM OPERATION. Prior to actuation of the d-c system, all a-c busses must be energized; transformer-rectifier switches, battery switch, and the non-essential bus control must be off; transformer-

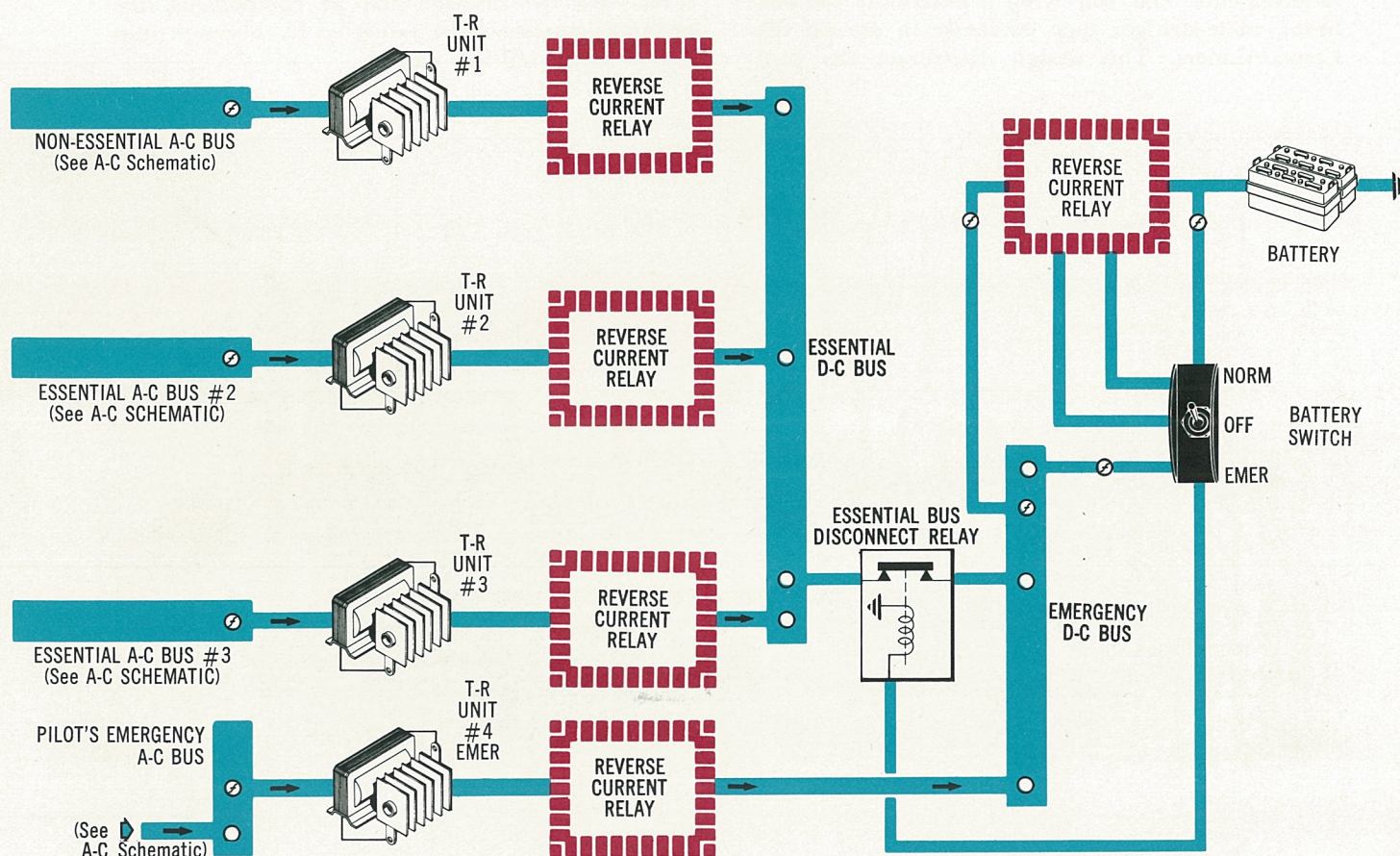
rectifier and the battery reverse current relay must be open.

When the d-c voltmeter indicates that the voltage output of the transformer-rectifiers has reached the required level, each of the transformer-rectifier control switches is turned on.

The No. 1 transformer-rectifier energizes the emergency d-c bus; Nos. 2 and 3 energize the essential d-c bus, and No. 4 energizes the non-essential d-c bus.

BATTERY OPERATION. Under normal flight conditions, the battery switch is turned to the "normal" position. This permits the battery to charge from the emergency bus. In the event of d-c power failure, the switch is turned to "emergency." This closes the battery reverse current relay and connects battery power to the d-c emergency bus. The battery can supply all emergency d-c power.

D-C SYSTEM



STRUCTURE

One of the more critical items in the fail-safe design of aircraft structures is the protection of the fuselage against explosive failure, following a partial rupture due to accidental damage.

To provide this protection in the '880,' Convair engineers have chosen heavy gauge 2024 aluminum alloy, working at low, pressure-induced stresses, for the fuselage skin. The 2024 alloy was selected for its superior resistance to crack propagation. Use of the heavy gauge is further justified by the gains made in noise suppression. In addition, Convair has incorporated crack-stopping details in the frame-to-skin design of the fuselage.

Minimum skin gauge is .063. Heavier material is used above the cabin floor line, where windows and most other openings are located.

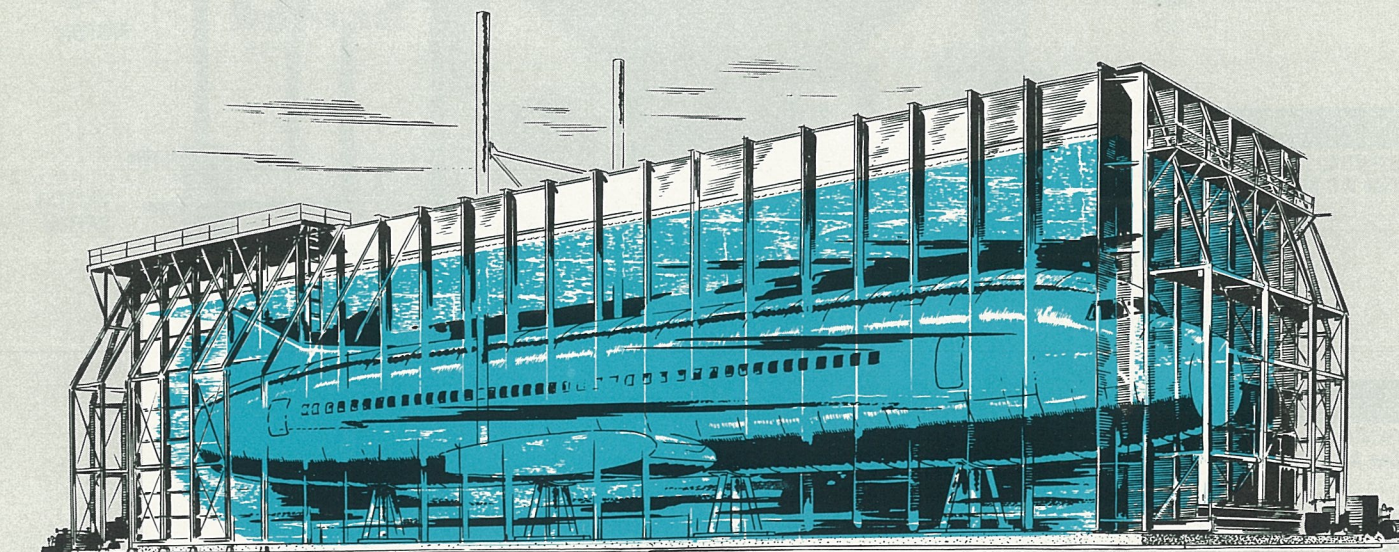
The wing structure design also fulfills fail-safe requirements. The '880' wing is essentially the box beam, plate-stringer type currently in use on the Convair-Liners. This design distributes the load

along many relatively small members, thus minimizing the importance of any single element.

There are important differences in wing design, however. The '880' wing has a heavier skin, and the lower wing surface, including skin, stringers, and spar caps, is constructed of 2024 aluminum alloy, as used in the fuselage sections. Further, from the wing centerline to the outboard engine, a three-spar, or two-cell, construction is used. This arrangement is both fail-safe and structurally economical.

Convair, who has done an outstanding amount of fatigue-testing of complete airplane components, will pressure-test the pilot's enclosure, doorway structures, window installations and other small components separately. The entire full-size fuselage will be fatigue-tested in a tank, currently in use on other transport evaluation programs.

As with the fuselage and its components, the wing structures will be subjected to thorough testing to assure fail-safe design.



LANDING GEAR

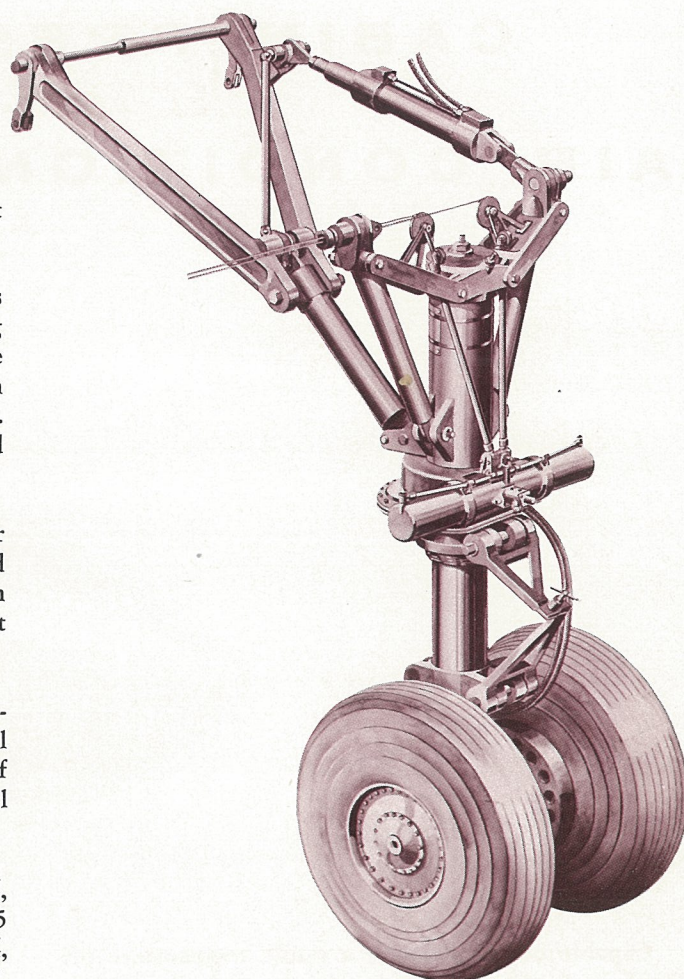
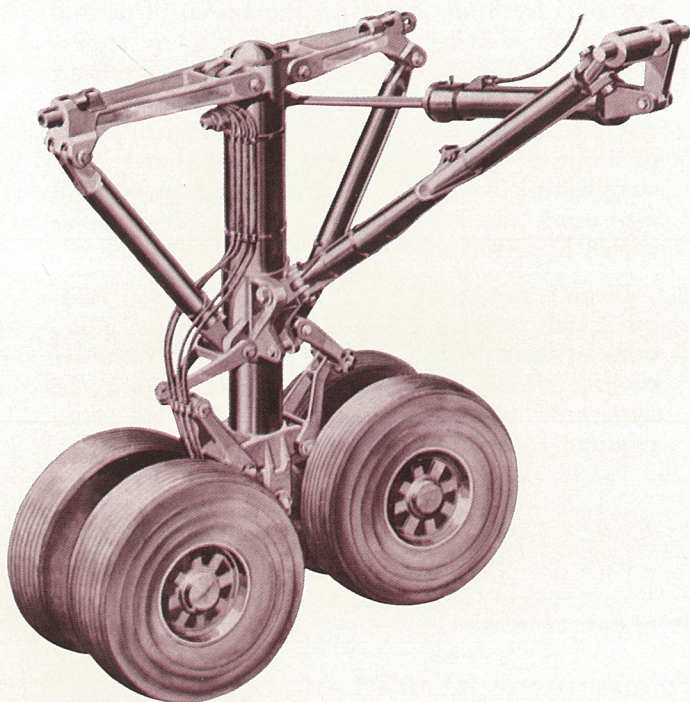
Simplicity, strength, and dependability are built into the Convair 880 tricycle landing gear.

The main gear consists of dual tandem trucks mounted aft of the center of gravity. The drag strut, the outer cylinder of the shock strut, and the trunnion beam form a pin-ended "A" frame which distributes the load along the axis of each member. This method of construction braces the gear and increases structural integrity.

When the main gear is lowered, upper and lower members of the folding side brace extend outboard and actuate a trigger latch which locks the gear in the extended position. Hooks and rollers are not used in the down-lock mechanism.

Manual release of door and gear uplock mechanism is provided for emergency use. When normal controls are in the "down" position, actuation of the manual release allows the landing gear to fall and lock.

Main gear tires are 20-ply rating nylon, 12.50-16, having an approximate maximum pressure of 115 psi. Nose gear tires are 12-ply rating nylon, 7.50-14, with an approximate maximum pressure of 80 psi.



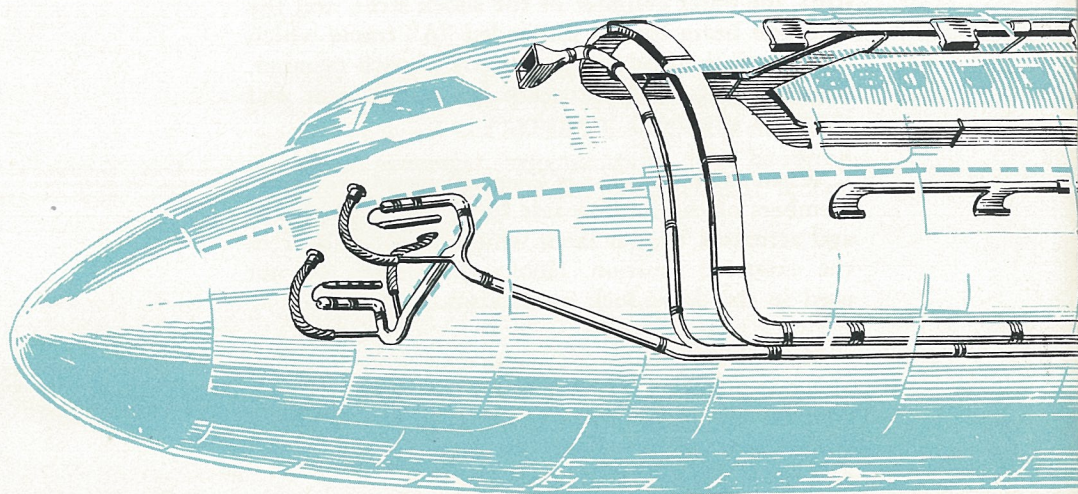
Like the main gear, the nose landing gear is designed for maximum load distribution within the members to increase integrity.

Nose gear wheels are mounted on a fixed axle, rather than on the conventional rotating beam. The co-rotation feature is made possible by an internal floating axle which couples the wheels.

A constant torque output steering motor turns the nose wheel through its 140° arc. The steering unit is controlled by a hand wheel on the flight deck. To aid in taxi controllability, a shutoff attachment automatically releases the brake when the nose wheel is turned beyond five degrees.

Design of the 880 landing gear is one of the factors which contributes to the jet-liner's ability to utilize present-day airport facilities. Efficient disc-type brakes on nose and main landing gear wheels help to shorten landing distances, and the weight-on-the-ramp-per-wheel, which is less than that of several contemporary piston transports, eliminates the possibility of damage to existing concrete runways and ramp areas.

CABIN PRESSURE and AIR CONDITIONING SYSTEMS



Capable of maintaining a stable temperature of 75°F in flight or 80°F on the ground, the "880" supercharger system delivers a complete change of cabin air every 2½ minutes. The refrigeration section of the system is either pneumatically or electrically powered, depending upon customer requirements.

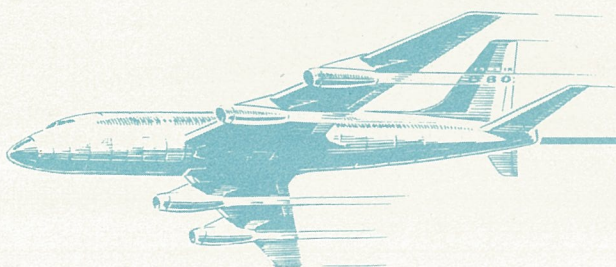
In the pneumatically-driven system, bleed air from the engines is used to drive the Freon compressors and the condensor cooling fans, while 200-volt ac from the main generators powers these units in the electrically-driven versions. In both designs, engine bleed air provides power for the cabin air compressor turbine, and electrical power drives the cabin air recirculating blower.

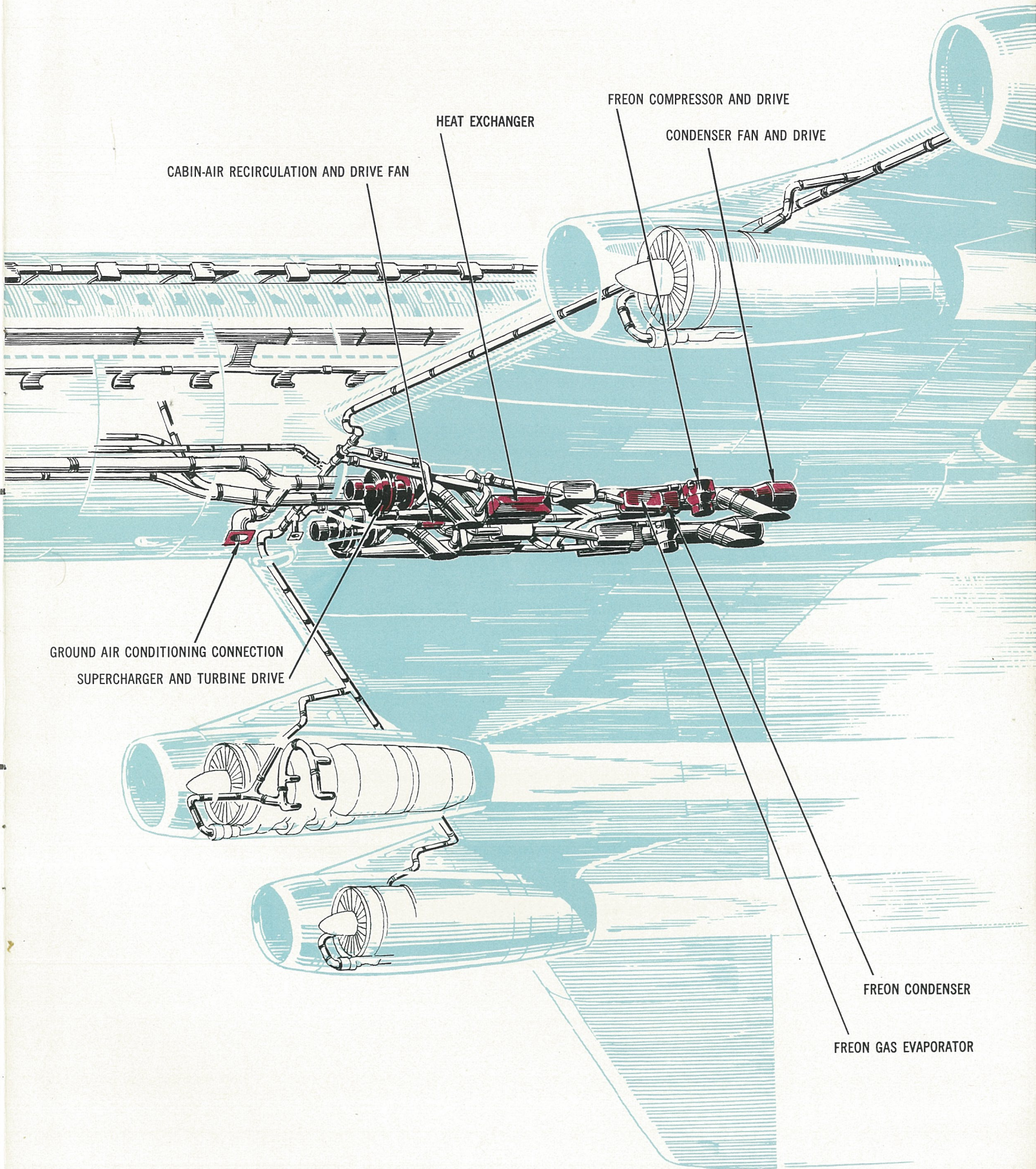
In flight, ram air is compressed and heated by the cabin air supercharger, and is routed through the air conditioning system for temperature con-

trol, as required. From there, the air enters the cabin and flight deck.

On the ground, in the pneumatically-powered versions, fresh air is drawn into the airplane and is compression-heated by the cabin air supercharger. In the electrically-driven system, fresh air is drawn into the system by the recirculating blower and passed through electric heaters located in the distribution ducting. Cooling on the ground is accomplished, in both versions, by drawing in fresh air, using the recirculating blower. This air is cooled by the Freon refrigeration systems.

Freon systems were chosen because of their flexibility and convenience in ground operations. Unlike other systems, commonly in use, Freon permits air cooling while loading and unloading passengers, with only nominal pneumatic or electric power required from a ground source.





THE JET ERA

Capable of speeds in excess of 615 mph, Convair's "880" will bring the advantages of commercial jet travel to short and intermediate range traffic, as well as to non-stop transcontinental flights.

The new jet-liner is another measure of Convair's leadership in the design and production of aircraft for short and medium range operation. This airplane, readily convertible to a variety of first-class and first-class-and-tourist seating arrangements, offers airline operators a versatility and flexibility of operation never before available.

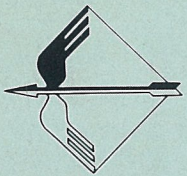
This versatility in operation is accompanied by economy. Direct operating costs for the new jet-liner are estimated to be between 1.73 and 1.78 cents per seat-mile, for flights of 1500 nautical miles or more.

Dominant factors in the economical operation of the "880" are the dependability and extensive service life of the General Electric CJ-805 engine, and the advances in ground handling, which reduce "on-the-ground" time to less than 25 minutes.

The "880" will be placed in service late in 1959 by major airlines in North and South America.







REAL
SA



NORTHEAST
AIRLINES



TWA
TRANS WORLD AIRLINES

CONVAIR



AIRCRAFT AROUND THE WORLD

Delta



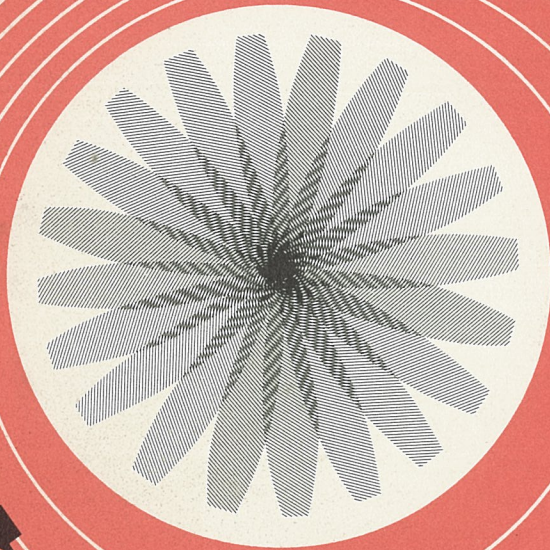
CONVAIR

Traveler

VOLUME IX

NUMBER 2

JULY 1957



CONVAIR *Traveler*

VOLUME IX NUMBER 2 JULY 1957

Chief Engineer
R. L. Bayless

Manager of Service
J. J. Alkazin

Chief Service Publications
H. R. Kennedy

*Chief Service Engineering—
Transport*
L. J. Bordelon

Chief Aircraft Change Service
O. W. Harper

Editor
G. S. Hunter

Writer
J. J. Mulvey

Art Editor
N. J. Rutherford

FOREWORD

Wind tunnel tests, using accurately scaled models of new designs or proposed modifications to existing airplanes, are necessary to the manufacture of modern aircraft.

Models of the Convair-Liners and the "880" underwent many thousands of hours of wind tunnel testing in order to prove out design features before the aircraft were placed into production.

Convair owns and operates two wind tunnels in San Diego, and is part owner of the Cooperative Wind Tunnel, located in Pasadena and operated by the California Institute of Technology. This issue of the *Traveler* describes various models and data-gathering techniques, and the characteristics of the three wind tunnels.

ON THE COVER

Wind tunnels are vital tools to aircraft designers. Artist Willis Goldsmith depicts one of the thousands of wind tunnel tests to which models of Convair's "880" have been subjected.

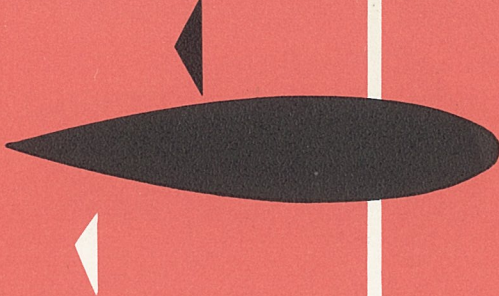


Copyright 1957

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of Convair-Liner operation and service published monthly by the Service Publications Section of Convair in the interest of Convair-Liner operators. Communications should be addressed to Manager of Service, Convair, San Diego 12, Calif.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without the specific approval of their cognizant organization.



WIND TUNNELS

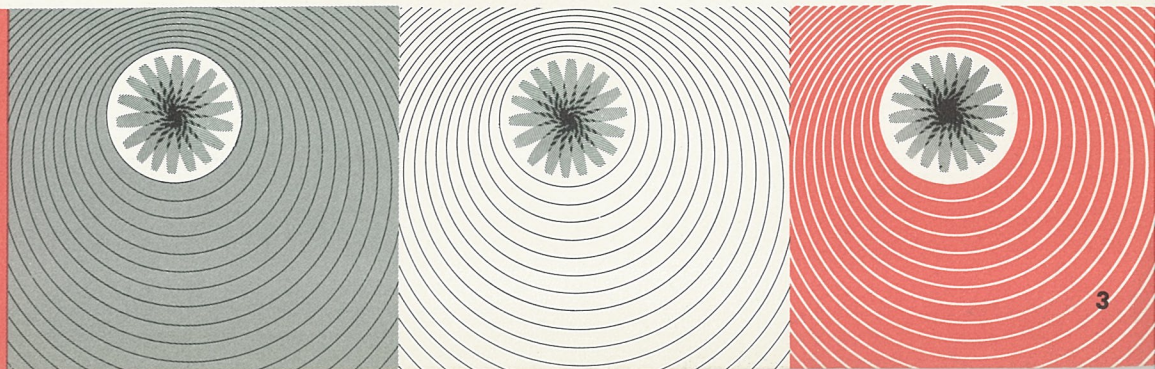
The ever-increasing speed of modern aircraft has presented designers with problems of corresponding complexity. Moments and forces once considered negligible may now react with totally unforeseen effect. What was once unusual is now expected, and seemingly slight changes in configuration may have effects out of all proportion to their magnitude.

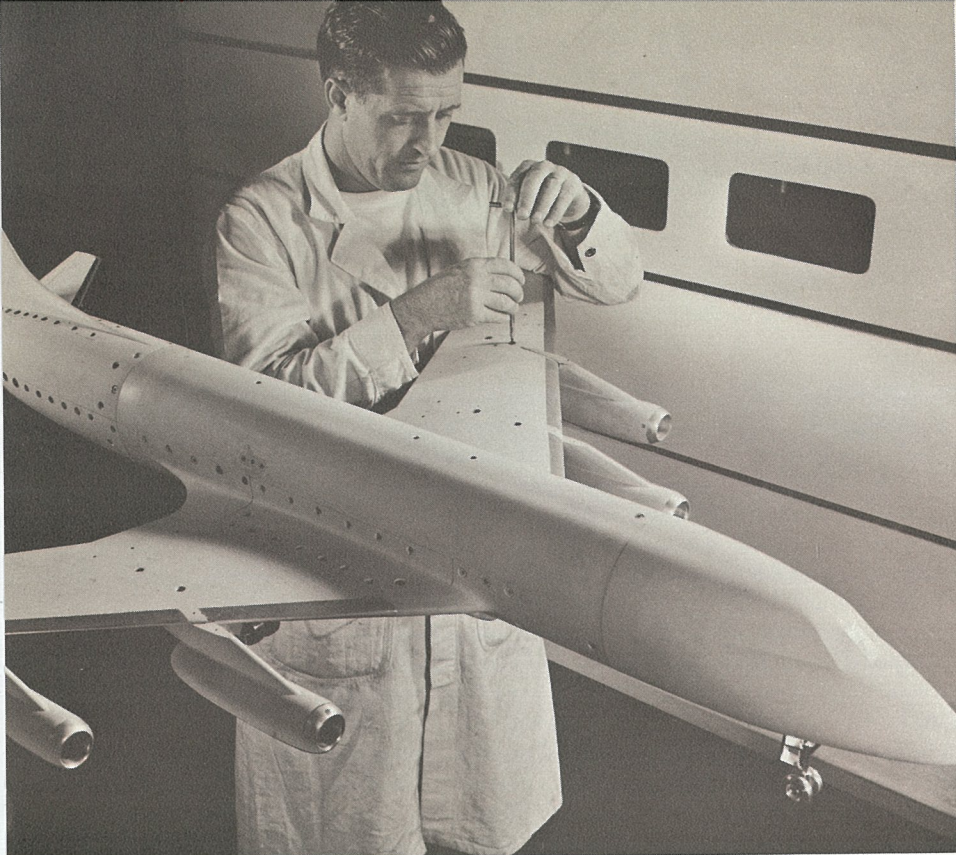
The number of man-hours involved in the design and construction of modern aircraft is so great that proposed changes must be evaluated before the airplane reaches production. Further, certain design changes may have adverse effects upon the safety, economic operation, or durability of the aircraft, thus making flight tests impractical. The only safe and economical way to evaluate new designs and proposed changes is through wind tunnel tests, using scale models.

Wind tunnel tests, whether high-speed or low-speed, generally fall into one of two classifications: 1) for research purposes — to gather basic data applicable to all aircraft in general; 2) for practical purposes — to predict the performance and flying qualities of actual aircraft.

When tests are made to gather data for research purposes, airplane components, such as the wings or the vertical fin, or perhaps the bare hull, are used. For instance, when a generic wing form is under test, the position, shape, and relative size of the movable surfaces are changed, and the leading edge and the airfoil of the wing may also be modified. These carefully planned changes in configuration give positive indications that certain combinations will be better than others under certain circumstances.

Where tests are made to prove out actual aircraft design, scale models of the complete airplane are generally used, although separate components also undergo considerable testing. Provisions are made to change the positions, and in some cases the shape, of the various components, by using attaching plates and aligning pins. In the case of propeller-driven aircraft, small high-speed electric motors may be used to provide data concerning propeller airflow.





An engineer makes a final adjustment to a scale model of Convair's "880" jet transport.

Models may be made of wood, fiberglass, or metal, or combinations of all three, and are constructed with extreme care, using scaled-down mold loft templates. Wings generally have steel spars and metal surfaces, to give the required structural strength and surface rigidity. All models are built to very close tolerances.

Five scale models of Convair's new jet-liner, the "880," have thus far been developed. They have undergone more than a thousand hours of wind tunnel testing, and will undergo many more.

One model, for low-speed testing, is used to obtain data regarding low-speed stability, control and handling characteristics, and data concerning the effect of various flap configurations on takeoff and landing characteristics.

The second model, tested at speeds up to Mach .95, is a high-speed force measuring model. Fitted with an internally mounted strain gage balance, it is used to measure lift, drag, side force, pitching moment, yawing moment, and rolling moment, so that high-speed stability and performance at maximum speed may be studied.

The third model is a high-speed pressure model containing over 400 pressure measuring orifices.

Data obtained from testing this model are used to determine structural loads which must be considered in the final design of the airplane, and to determine the effects of airflow at high speeds.

The fourth model is a large scale model of the Mach .98 to enable engineers to obtain basic data for control systems design. The model consists of a tail cone, the vertical fin and the horizontal stabilizer, and includes all flight control surfaces, which can be adjusted by remote control devices while the model is being tested. This remote control feature permits a great deal of highly accurate data to be gathered in a comparatively short time, since the wind tunnel does not have to be shut down to change the attitude of the control surfaces.

The fifth model, also tested at high speeds, is used to determine flutter characteristics.

As a result of testing these "880" models, many design features and theories have been proved out, and a few design modifications have been made. Testing, for instance, proved out the present location of the horizontal stabilizer, and showed that slight changes were required in the wing airfoil section and in the twist of the wing chord planes.

Scale models of the propeller-driven Convair-Liners were also examined in thousands of hours of tests, before the airplanes were placed into production.

The "880" and the Convair-Liner models were 'flown' with landing gear retracted or extended and, in the case of the Convair-Liner models, with propellers feathered or windmilling. Tests were made with the model carrying various simulated gross weights, at different speeds, and with the model in various attitudes. String tufts were attached to the model to give visual indication of variations of airflow.

Models were so constructed that changes in configuration could be made quickly and easily. Adjustable control surfaces were provided, and the vertical fin and the horizontal stabilizer were fixed into place with screw plates and aligning pins, for easy removal and repositioning. Changes were made in the horizontal stabilizer leading and trailing edges, and the stabilizer was tested in various positions, from the top of the vertical fin to the centerline of the fuselage.

Removable wing sections, of aluminum alloy, were fitted on the leading and trailing edges of the wing and to the trailing edge of the elevators, to provide changes in size and shape, so as to obtain a wing of optimum performance.

The wing was also provided with adjustments for various amounts of dihedral. Various wing-to-fuselage fillets, made of fiberglass reinforced metallic-plastic blocks, were interchanged on the models.

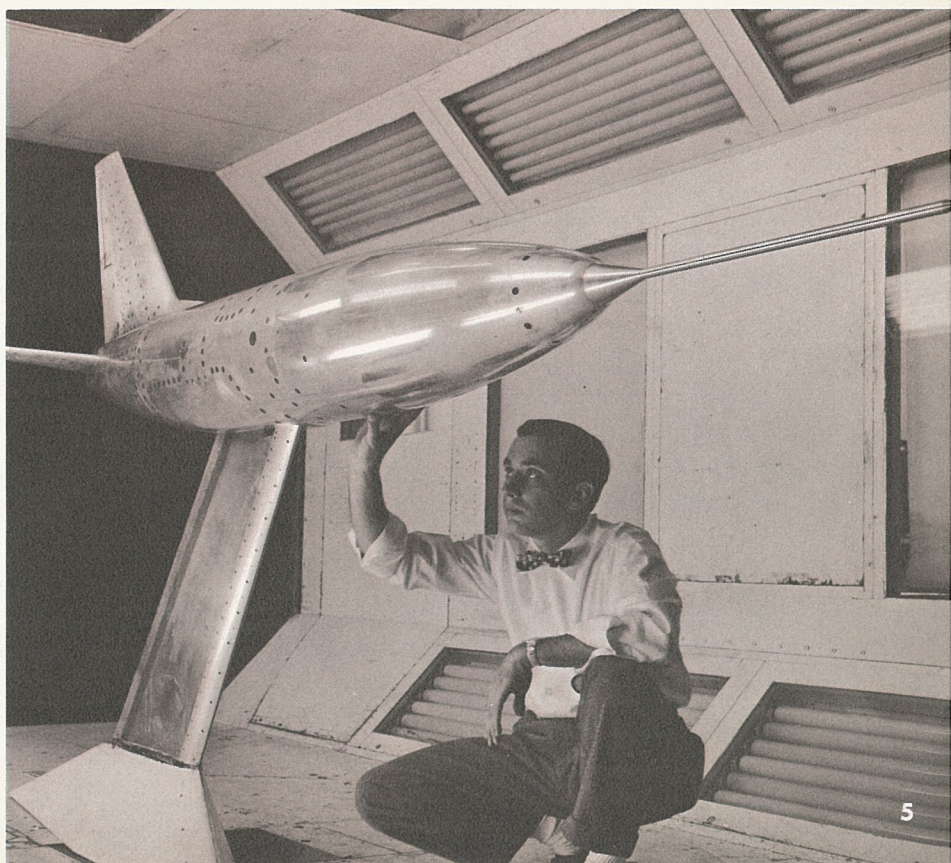
Wings and wing flaps were extensively tested. Several variations of flaps were mounted on the

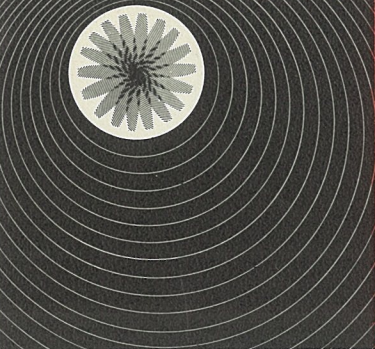
model of the complete airplane, and flap action was also tested on a wing section. The airplane was 'flown' in various configurations of flap and aileron deflection to test the reaction of the airplane to these deflections.

Propeller airflow effect was studied by using scale model propellers, both three- and four-bladed, driven by high-speed electric motors embedded in the engine nacelles of the models.

Scale models were built and tested by Convair for many years before testing began on the Convair-Liner design, and Convair had long recognized the need for adequate research facilities. This need became extremely acute with the beginning of the second World War. Prior to that time, most of the developmental work in aircraft design was done at the wind tunnels of the California Institute of Technology and the Massachusetts Institute of Technology. Due to the demands placed on these facilities by government research and by manufacturers, the time lag in obtaining data could no longer be afforded, and many manufacturers — Convair among them—turned to the construction of their own tunnels. Today, Convair has in operation one tunnel in San Diego, built in 1945, for use in testing designs at speeds under 350 mph; has a part interest in the Southern California Cooperative Wind Tunnel at Pasadena, operated by the California Institute of Technology, and is presently constructing another tunnel in San Diego, where wind velocities will reach Mach 5, or 3,800 mph.

A model of the "880" empennage, with movable control surfaces, is readied for testing.





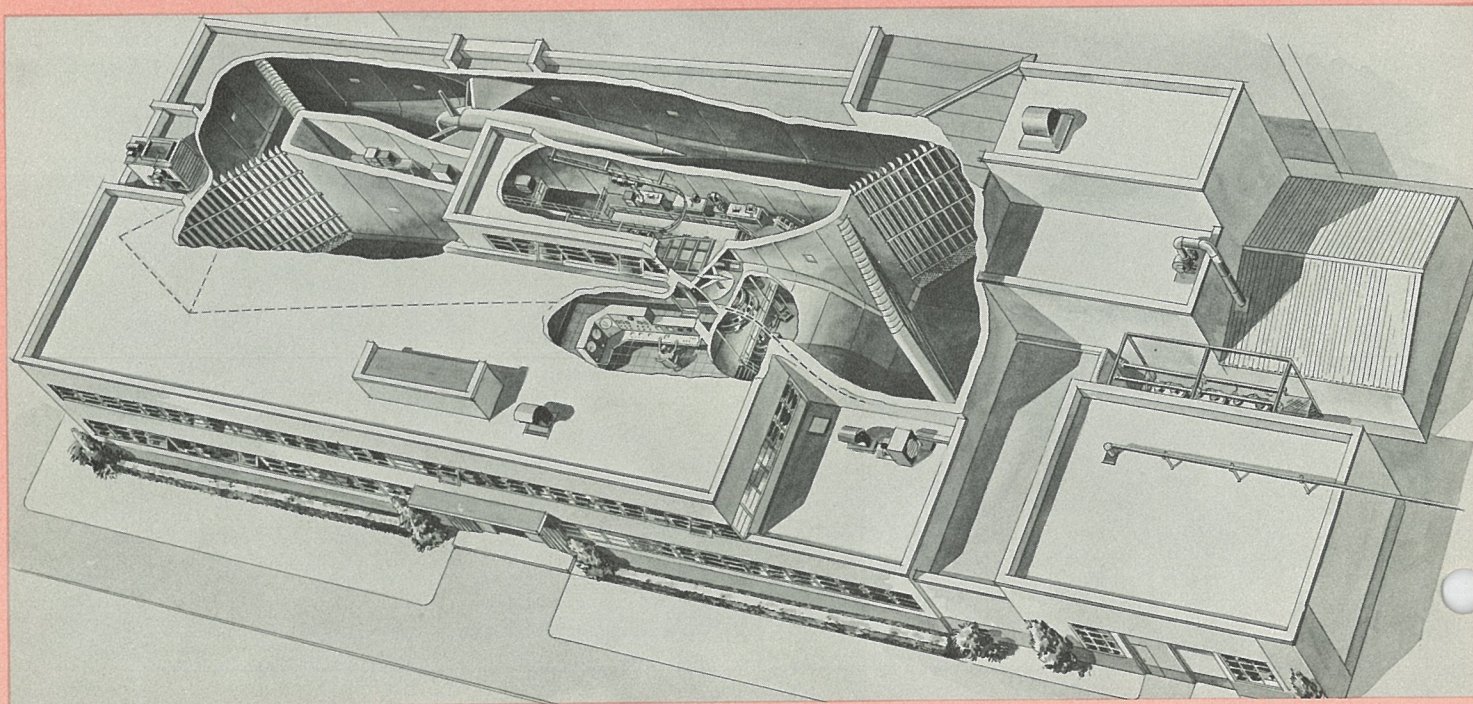
CONVAIR LOW-SPEED WIND TUNNEL

The 350-mph low-speed tunnel is a closed-return, or continuous-flow type, with a test section of 8' x 12', which will accommodate complete model airplanes with wing spans up to 11 feet. Airflow in the tunnel is created by a propeller, 20 feet in diameter, driven by a 1750-hp synchronous motor. The motor is mounted inside a seven foot diameter nacelle, supported from the walls of the tunnel by cast-steel struts, aerodynamically designed to remove the propeller rotational effect from the airstream. The air passes from the fan and is routed to the test section by water-cooled turning vanes.

Velocity of the air is closely measured and controlled by a "Q" balance system, operated in conjunction with the fan motor speed control. Motor speed can be controlled in increments of 1 rpm, and the control system will hold the rpm selected by the test technician to $\frac{1}{4}$ of 1% accuracy.

This same degree of accuracy is maintained in the balance system, which measures and transmits the loads created on the model by the wind flowing through the test section. The balance system operates on the null principle. That is, the system does not measure the amount of travel of its components, but instead measures the amount of force necessary to keep the system in equilibrium. This permits extremely accurate measurements, and freedom from any forces not created by loads on the model.

The models transfer loads to a heavy cross-beam, whose three legs rest on spherical oil pads, equally spaced around a ring. The legs of the cross-beam are connected, through attaching struts, to hydraulic capsules also located on the ring. The ring rests on a circular base, supported on vertical attaching struts to three hydraulic capsules installed on a massive concrete inertia block. In addition, three more hydraulic capsules are attached to the rim of the circular base, and are connected through attaching



horizontal struts to rigid vertical restraining arms, which in turn are anchored to the inertia block.

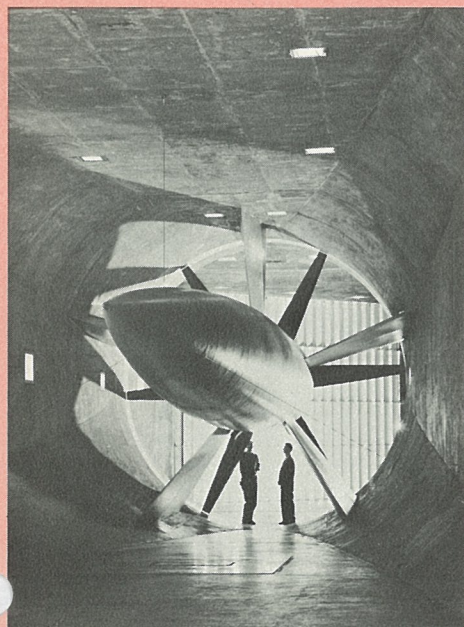
The spherical oil pads on the cross-beam legs permit frictionless rotation of the model under test and, as the model reacts to loads, the various capsules also react. The capsules on the ring react to the movement of the cross-beam legs, and measure Pitching, Rolling and Yawing Moments; the three capsules on the inertia block react to the movement of the circular base and measure Lift forces; the three capsules attached to the circular base also react to the movement of the base, and measure Cross-Wind and Drag forces.

By using the hydraulic capsules in conjunction with this 'pyramid' type of suspension system, all the forces and moments are automatically segregated and, at the same time, the moment capsules yaw with the model under test. This permits direct read-

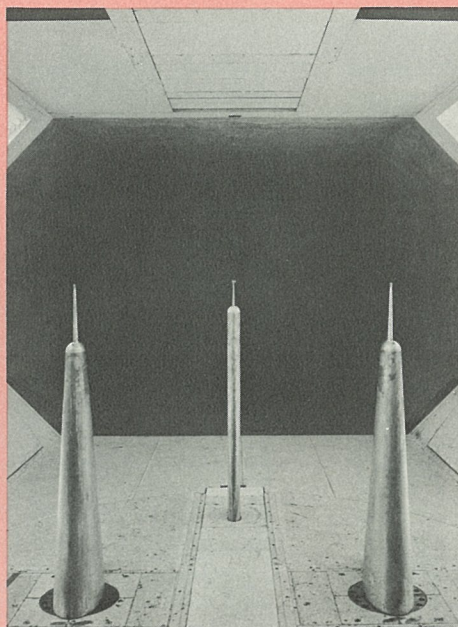
ing of the Lift, Drag, and Cross-Wind forces about the wind axis, and the Pitching, Rolling and Yawing moments about the stability axis of the model.

The hydraulic capsules consist of a rigid cylinder and piston unit. Forces exerted on the pistons through the attaching struts are balanced by pressure developed within the capsules. The resulting pressure changes are instantly transmitted to the indicating system. There is no fluid flow, no volume change, negligible inertia, and the movement of the piston for full load is less than one-thousandth of an inch.

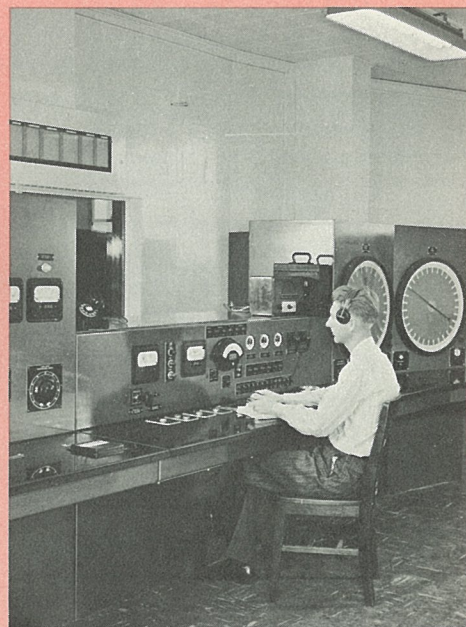
Load values are transmitted simultaneously to Tate-Emery Null Method indicators, and to electronic recorders and computers. Data from the tests are analyzed and made available to test engineers in a matter of minutes.



The fan blades, struts, and nacelle in the Convair Low-Speed Tunnel.



One set of the model-supporting and data-transmitting struts.



The Tate-Emery Null Method Indicators (left) in the tunnel control room.

COOPERATIVE WIND TUNNEL

Tate-Emery indicators and the 'pyramid' system of model suspension are also in use at the California Institute of Technology Wind Tunnel in Pasadena. However, an electronic measuring system, which operates independently of the 'pyramid' system, is presently the principal system in use. This electronic system gathers data from a six component internal strain gage balance, inserted through the rear of the fuselage (into the tail) of the model being tested.

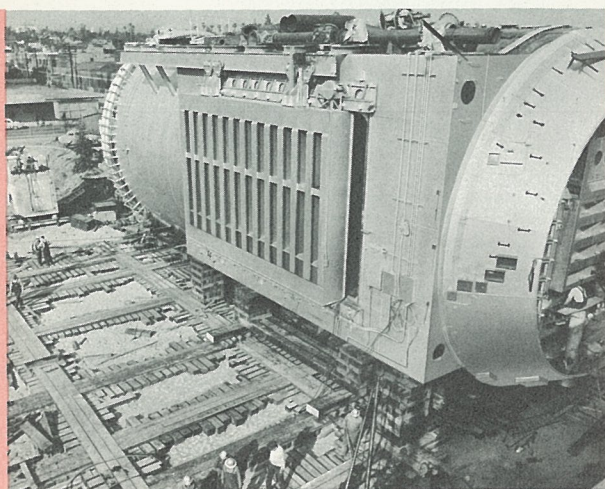
The tunnel, of which Convair is a part owner, is the closed-return, continuous-flow type, similar to the Convair tunnel in San Diego, and has a speed range of up to Mach 1.8, or about 1370 mph. Air flow is created by two 20,000-hp electric motors, which drive four 21-foot in diameter variable-pitch fans, mounted in tandem. Variation in air flow is obtained by changing the pitch of the fan blades, since the motors operate at a constant speed of 600 rpm. Pitch may be changed during test runs by remote controls.

The test section is situated in an airlock, which can be isolated from the rest of the tunnel by two gate valves, one on each side of the test section. This arrangement enables pressure to be maintained in the tunnel whenever the test section must be opened, thus reducing to a minimum the time necessary to re-stabilize tunnel pressure. The tunnel is equipped with compressors capable of changing the tunnel internal pressure from 0.1 atmospheric pressure to four times atmospheric pressure.

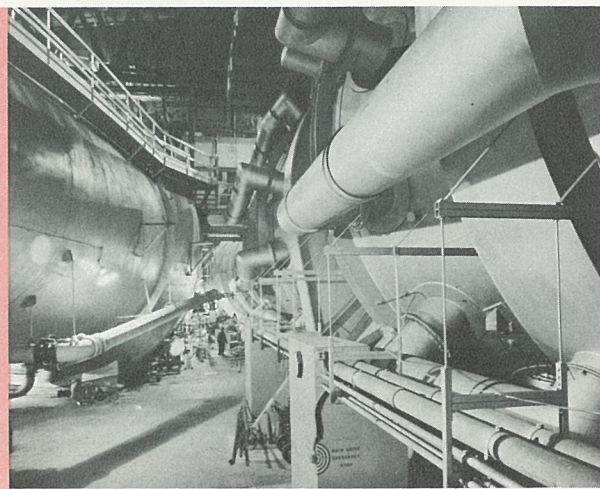
Models may be mounted on any one of three carts, which are specifically designed for subsonic, transonic, or supersonic service. One cart is a conventional solid wall subsonic test section, the second is a ventilated transonic throat for Mach numbers to 1.3, and the third is a flexible nozzle supersonic throat for Mach numbers to 1.8. The carts are propelled by electric motors, and roll on tracks to and from the model shops. While tests are being conducted, using one cart, preparations for testing with the other carts can be made. When tests are to be made at different speed ranges, this arrangement saves considerable time.

The 'pyramid' force and moment measuring system in the Cal-Tech tunnel is very much the same as that used in the Convair low-speed tunnel. When the carts, which contain the entire model suspension system, are rolled into the test section, they are connected into the measuring system by hydraulic and electrical connectors. The legs are jacked up, so that the entire cart is supported on the measuring system. The system consists of the hydraulic capsules, spherical oil pads, and electronic recorders discussed previously. The 'pyramid' system is inoperative whenever the strain gage system is used.

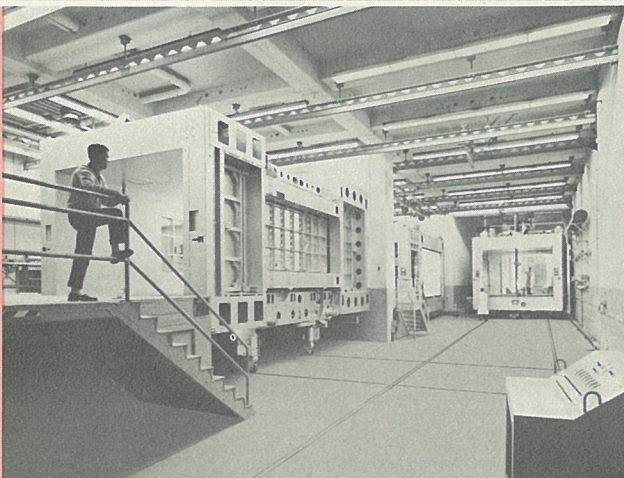
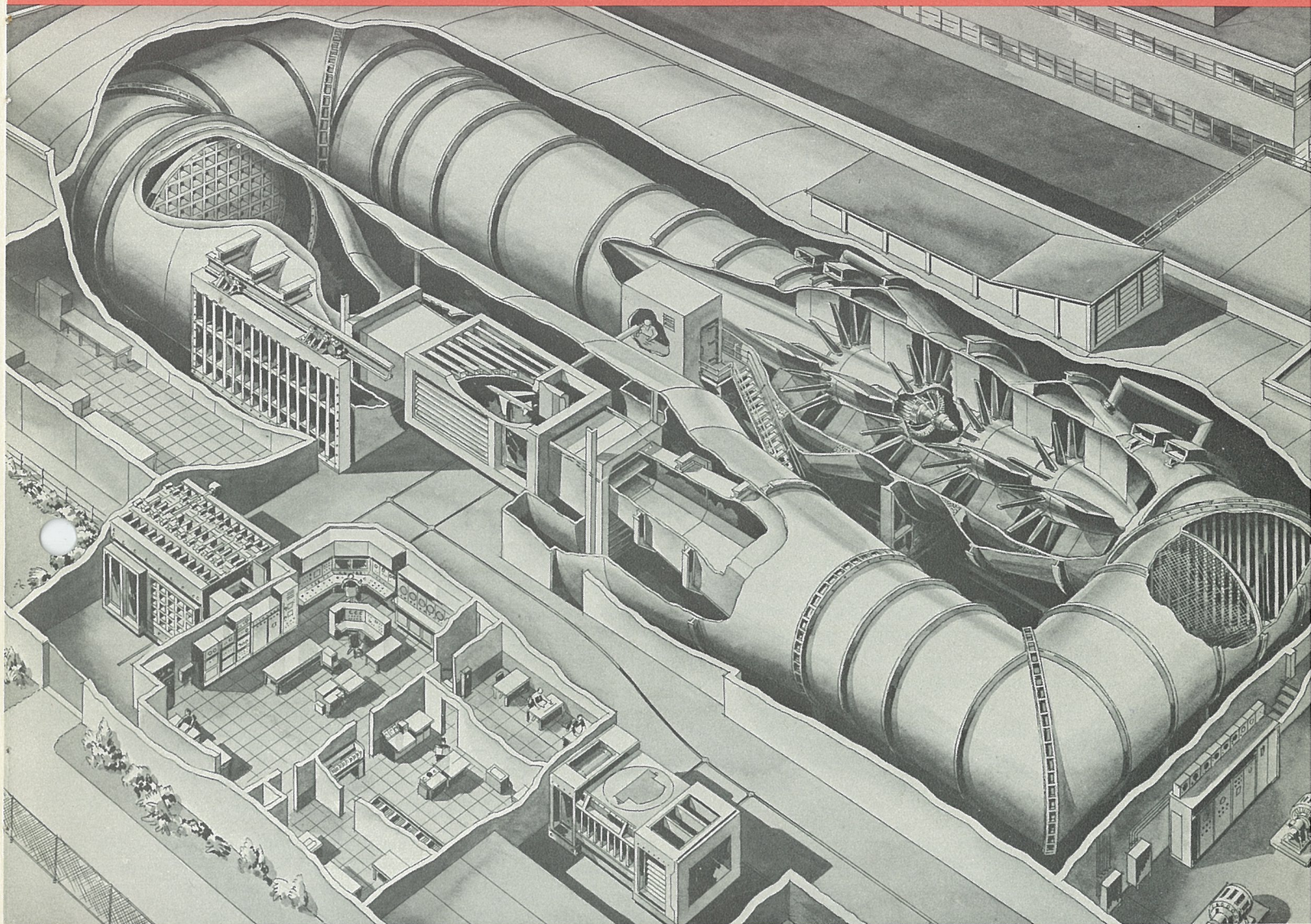
Results of tests are automatically analyzed by electronic computers, and are made available to test engineers within eight seconds after the completion of a test run.



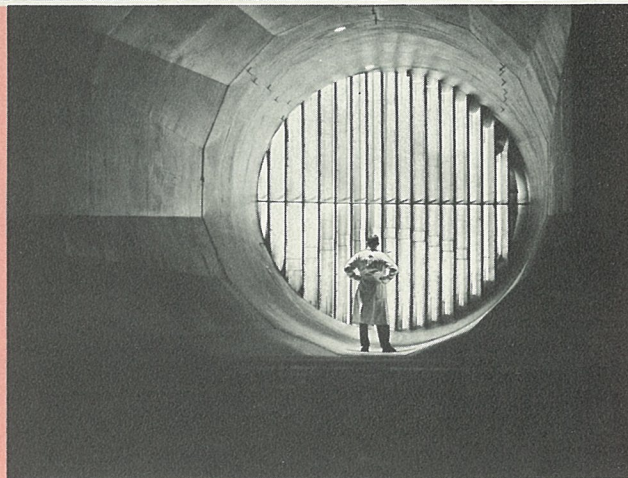
The massive airlock and model test section of the tunnel are moved into position.



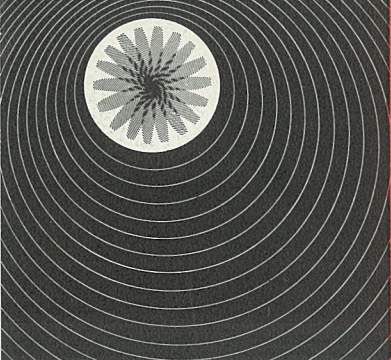
Model test section (left), and main drive section (right), in the Cooperative Wind Tunnel.



In the background, one of the self-propelled model carts is readied for testing.



A technician examines one set of the tunnel water-cooled wind turning vanes.



CONVAIR HIGH-SPEED WIND TUNNEL

The wind velocities in the low-speed tunnel and in the Pasadena tunnel are sufficient for testing aircraft designs at speeds up to Mach 1.8, or approximately 1370 mph. However, it has become evident that even these high speeds will not suffice to test designs for the commercial airliners of the future. The present day performance of military aircraft gives an indication of the commercial performance of tomorrow. And, as in 1942, the need for adequate research facilities has again become critical.

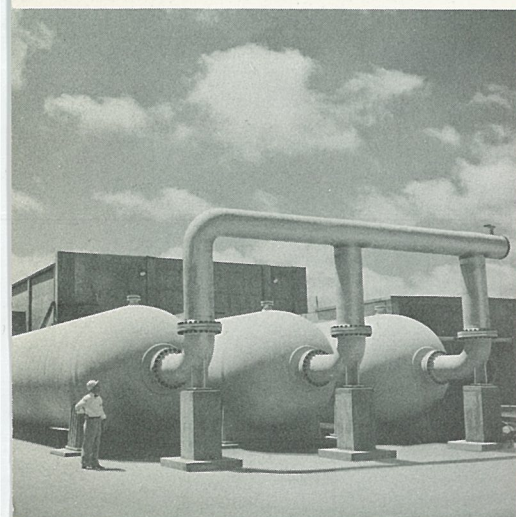
Convair, recognizing these facts, is presently constructing a high-speed tunnel, which will afford engineers an opportunity to test aircraft design at velocities from Mach 0.5 up to Mach 5, or 3,800 mph.

The tunnel is a blow-down, intermittent-flow type, rather than the closed-return, continuous-flow type at Pasadena and in the Convair low-speed tunnel. The blow-down design was chosen because of its comparative simplicity and because only a fraction of the horsepower required in continuous flow tunnels is needed. The new wind tunnel employs an 8,000-hp motor to develop a wind velocity of 3,800 mph; a continuous-flow tunnel would require almost 150,000 hp to deliver the same velocity. Further, it is not necessary or feasible to install the massive and complicated force and measuring 'pyramid' sys-

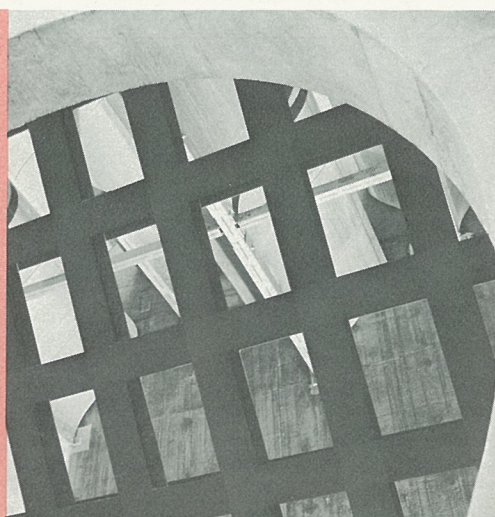
tems used in the continuous-flow tunnels. Rather than transmitting the forces imposed on the model through supports and hydraulic capsules, strain gages, inserted into the tails of the models, are used. The heavy shell of the continuous-flow tunnel, with its water-cooled turning vanes, and cooling radiators, is not required, since the Convair high-speed tunnel is essentially a straight tube, and only a settling chamber is necessary to control the flow of air as it is discharged into the tunnel.

High wind velocities are created in the tunnel by compressing air to 600 psia with an 8,000-hp, electric-motor-driven, three-stage compressor, and storing the air in six tanks, from which it is discharged as required. Run times in the tunnel are short — from 20 seconds to 60 seconds in duration — and the compressor system provides air for two to four blows per hour, depending on test requirements.

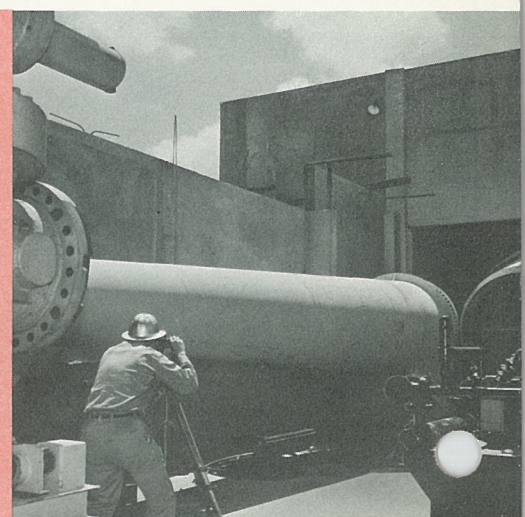
The storage tanks, each 10 feet in diameter by 63 feet long, have a total storage capacity of 28,000 cubic feet of air at 600 psia. Each tank contains a bed of alumina balls, used for temperature stabilization. The alumina balls, which constitute a thermal mass, pick up heat from the air as it enters the tanks and give up heat to the air as it is discharged, thus maintaining temperatures in the tunnel within specified limits.



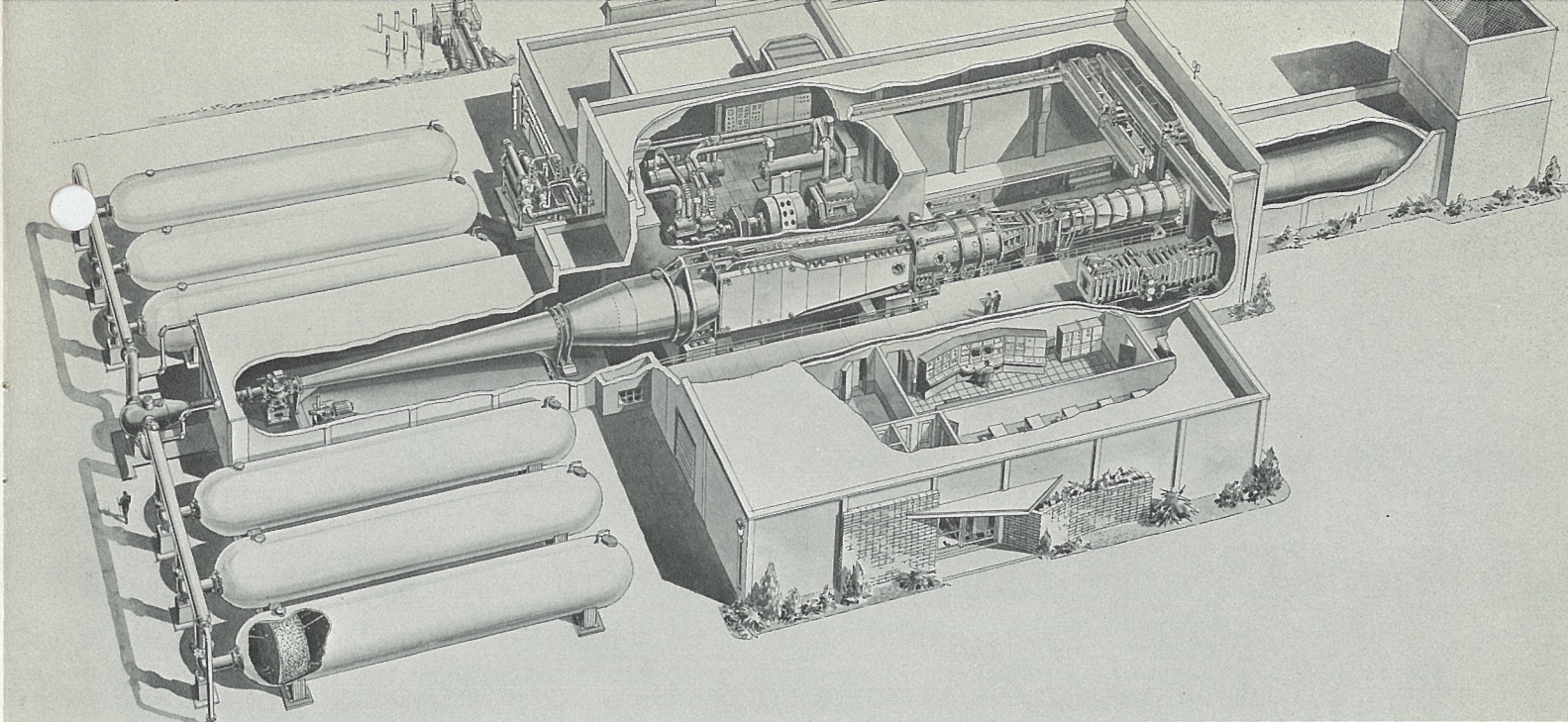
Three of the 10' x 63' air storage tanks for the Convair High-Speed Tunnel.



The heavy steel barrier and the silencers in the concrete exhaust muffler.



The settling chamber (right) is aligned with the gate valve (left).



The tanks discharge the air through an electronically controlled gate valve into a settling chamber. The settling chamber, approximately 14 feet in diameter, is designed to admit air into the flexible nozzle of the tunnel with a minimum of turbulence.

The flexible nozzle, which determines the rate of supersonic flow, has a 4 foot by 8 foot entrance from the settling chamber, and is 38 feet long, terminating in a 4 foot by 4 foot test section. The sides of the nozzle are composed of stainless clad steel plates, and the top and bottom plates are of solid stainless steel. The top and bottom plates are flexible and are actuated by hydraulic jacks, which bend the plates to the positions required to give a certain rate of flow. The jacks are controlled from the control console, and new rate-of-flow settings may be made in less than 15 minutes.

From the flexible nozzle, the air passes into a variable diffuser. As with the flexible nozzle, the surfaces of the diffuser walls are of stainless steel, and are also flexed by hydraulic jacks, as necessary.

The diffuser is mounted on rails to permit rapid and easy access to the model. To gain access, a portion of a fixed diffuser, located downstream from the variable diffuser, telescopes, and quick opening locks release the variable diffuser from the flexible nozzle. The variable diffuser is then rolled downstream, exposing the model and model support.

When transonic testing is required, the variable diffuser is moved to one side, and a transonic test section, which is stored next to the variable diffuser, is moved into position, and locked to the flexible nozzle. All of these procedures are power operated, and changing the test sections takes but a matter of minutes.

Air passes from the variable diffuser, or the transonic test section, into a fixed, subsonic diffuser. This diffuser has a telescoping section, to allow for downstream movement of the test sections, and is connected to a muffler, which substantially reduces the noise level of the exhausting air.

During tests, models are supported on a sting-type tail support mounted on a parallelogram type strut, which is in turn mounted on a powered carriage, which is moved to either the supersonic or transonic test section as required. When supersonic tests are being made, the model projects into the last six feet of the flexible nozzle, and when transonic tests are made, the model and support are rolled downstream and positioned in the transonic test section.

The model sting support is driven by a hydraulic cylinder through a pitch range of -15° to $+25^{\circ}$ at variable rates. During a test, the model is placed in an attitude which will cause minimum starting loads. After the flow of air through the tunnel has been stabilized, the data handling system initiates the pitch movement of the model. The model moves from the initial set position to a maximum negative attitude, then through the pitch arc to a maximum positive attitude, and finally to the initial set position, at which time the air flow is shut off.

While the model moves through the pitch arc, strain gages gather data and transmit it to electronic recorders and analyzers. In addition, Schlieren optical equipment and television circuits record shock wave phenomena and airflow.

The new tunnel will be placed into service late in 1957.



CONVAIR
Traveler

VOLUME IX

NUMBER 3

AUGUST 1957



MAINTENANCE

CONVAIR *Traveler*

VOLUME IX

NUMBER 3

AUGUST 1957

Chief Engineer
R. L. Bayless

Manager of Service
J. J. Alkazin

Chief Service Publications
H. R. Kennedy

*Chief Service Engineering—
Transport*
L. J. Bordelon

Chief Aircraft Change Service
O. W. Harper

Editor
G. S. Hunter

Art Editor
N. J. Rutherford

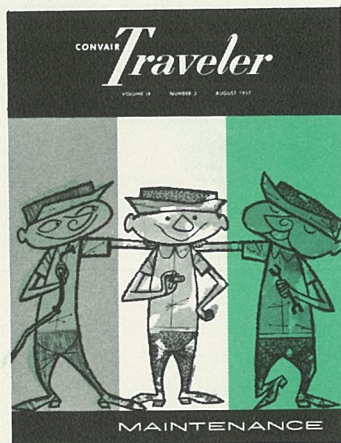
FOREWORD

Safety in aircraft maintenance work is dependent on the individual crewman's own alertness, respect for the dangers of the task, and know-how. Aircraft maintenance work, which in itself is not a hazardous occupation, can become dangerous if these three basic rules of safety are ignored.

The Traveler this month discusses some of the areas . . . fueling, general maintenance, handling of toxic materials, and electrical work . . . in which injuries to personnel most commonly occur, and presents some of the safety rules which should be observed whenever work is being done in these areas.

ON THE COVER

Willis Goldsmith's trio of maintenance men might aptly be called the Bungle Brothers. Their careless cavorting and complete disregard for even the most basic safety rules make them early candidates for permanent grounding — six feet under.



Copyright 1957

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of Convair-Liner operation and service published monthly by the Service Publications Section of Convair in the interest of Convair-Liner operators. Communications should be addressed to Manager of Service, Convair, San Diego 12, Calif.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without the specific approval of their cognizant organization.

SAFE MAINTENANCE PRACTICES

"Aviation in itself is not inherently dangerous, but, like the sea, it is terribly unforgiving of any carelessness, incapacity, or neglect."

Those who maintain and service aircraft have a two-fold responsibility . . . one to the passengers and crew of the aircraft and the other to themselves. Occasionally, due to constant exposure to the hazards of aviation maintenance, a crewman or mechanic fails to keep these hazards in mind, and the mistake that he makes can have serious consequences. Many accidents, to aircraft or to ground personnel, take place in areas of everyday familiarity . . . fueling, general maintenance, and electrical repairs . . . and most of these accidents are due to carelessness, not to ignorance or inexperience.

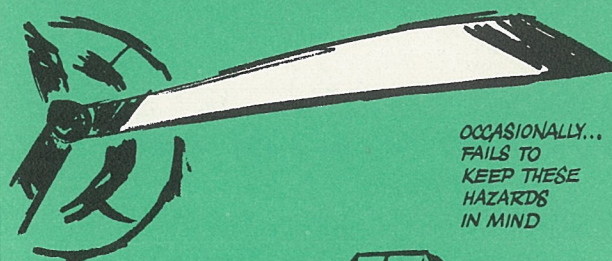
SAFE FUELING PRACTICES

The men who fuel airplanes are subjected to many hazards, and work operations under difficult conditions. Usually pressed for time, harried by wind and weather, heat and cold, darkness and the glare of lights, they must always exercise the utmost care and caution. With the advent of the jet engine in commercial aviation, their work becomes even more critical to safe operation.

The problem of handling jet fuel, evident in military aviation, will become acute as jet aircraft enter commercial traffic. In addition to being able to recognize the different grades of aviation gasoline, the refueling crewman must be absolutely certain that turbine fuel is not being placed aboard piston-engine aircraft, and that aviation gasoline is not being pumped into jet tanks.

The various grades of aviation gasoline may be recognized by their color. Turbine fuels are colorless.

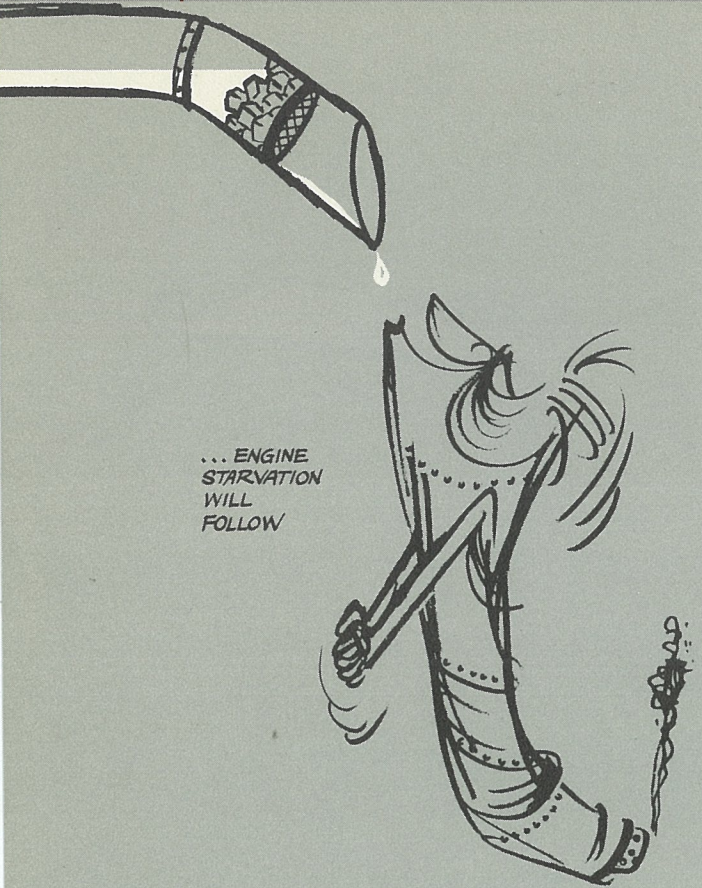
<i>Fuel</i>	<i>Color of Fuel</i>
115/145 grade	Purple
108/135 grade	Brown
100/130 grade	Green
91/96 grade	Blue
80 grade	Red
Turbine Fuel	Colorless



OCCASIONALLY...
FAILS TO
KEEP THESE
HAZARDS
IN MIND



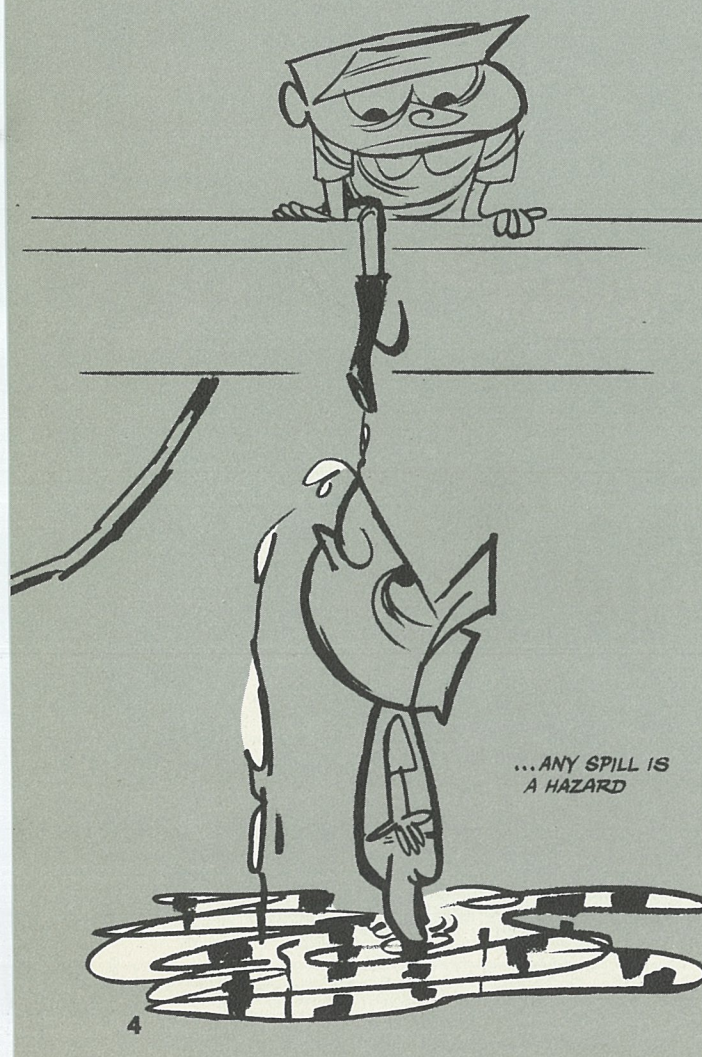
...HARRIED BY WIND AND WEATHER



... ENGINE
STARVATION
WILL
FOLLOW

Water in fuel is a constant problem, and the jet age will increase the difficulty. Turbine-powered aircraft, which operate at higher altitudes than do piston-engine aircraft, will encounter greater temperature changes. This will result in more condensation when damper, warmer air is drawn into the cold tanks as the airplane lets down from altitude. Because of the greater density of turbine fuel, water will not settle as rapidly as it does in aviation gasoline. (Settling time for water in turbine fuel is approximately four times that of settling time for water in aviation gasoline.) As a result, if care is not taken, the condensed water may freeze before it reaches the aircraft sumps and, if ice particles clog the fuel screens, engine starvation will follow.

Jet aircraft ground maneuvers also present a problem not found in reciprocating-engine aircraft. Jet exhaust is dangerous. Fueling should not be accomplished within 120 feet downstream of the tailpipe of a jet airplane which has an engine running. If a jet airplane moves into this area, fueling should be stopped immediately, the tank caps closed, and the tank truck removed from the area.



... ANY SPILL IS
A HAZARD

4

Poor grounding practices are sometimes encountered during fueling. It should be remembered that a drag chain from a fuel truck is not a suitable ground . . . fuel trucks must be connected to ground posts. A conductive type fuel hose is not a suitable ground . . . the truck must be connected to the aircraft by a bonding cable.

The aircraft should be grounded from an unpainted metal part, and a bonding cable connected from the fuel nozzle to the aircraft before the tank cover is opened. Bonding of the nozzle is accomplished automatically during underwing fueling, since the in-the-wing fitting and the nozzle are securely locked to each other.

Underwing pressure fueling substantially reduces the prevalence of another fueling hazard . . . spills. Any spill, regardless of size, is a hazard, and spills over six feet in any dimension constitute an extreme hazard.

In the case of large spills, the airport emergency fire crew should be called at once. Motorized equipment operating *outside* the spill area should be moved away or shut down as quickly as possible. The throttle should be closed and the engine killed by choking the carburetor because shutting off the engine ignition at full throttle may cause backfires.

If the fueling equipment is operating *inside* the spill area, *leave it alone*. The fire department will eliminate the danger with special equipment.

Large spills should be covered with foam, and then washed away or allowed to evaporate completely. When washing spills, the area should be flooded liberally, to prevent gasoline vapor from forming in storm drains. *Carbon tetrachloride should not be used*. It is only partially effective, and it may become a toxic hazard.

Clothing on which aviation gasoline or jet fuel has been spilled should be removed immediately. Neglect of a sleeve or cuff that has been soaked in fuel, or in any flammable liquid, can lead to painful burns.

The increasing use of radar, including airborne weather-mapping equipment, intensifies the fueling hazard. In a test of radar equipment to determine the range of dangerous effects, the beam was directed at a variety of objects with the following results.

Dry steel wool was ignited at a distance of 45 feet.

An explosion was caused in a mixture of aluminum chips and gasoline vapor and air, at a distance of 250 feet.

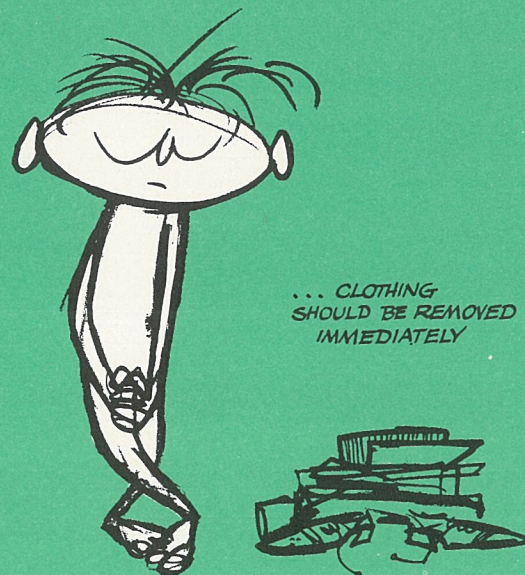
Audible and visible sparking was caused among metallic chips in a paper bag at a distance of 275 feet.

Hand tools became heated and gave off sparks at various distances from the radar source.

The foregoing emphasizes the admonition concerning refueling near operating radar or high-frequency radio transmitters.

Because of the long range electrical arcing effect of radar, proper housekeeping conditions are essential to safety. This includes the removal of trash, metal scraps, and oil rags. Some attention should be given to the placement and use of hand tools, also.

Other electrical equipment to which particular attention should be paid includes ground power units. Aircraft ground power generators and rectifiers should not be located down-wind or near the fueling points, and should not be connected or disconnected, stopped or started during fueling operations.



SAFE GENERAL MAINTENANCE

... DANGER FROM
FRAGMENTATION
EXISTS



Safety in general maintenance work is largely dependent on alertness, respect for the hazards of the work, and good housekeeping. A little special knowledge helps a lot, too.

Awareness of the danger of working near a spinning propeller is part of the alertness required in maintenance work. A propeller may break loose from the engine . . . carelessly-located tool boxes or improperly-braked ground equipment may strike a spinning blade. In either case, considerable damage and danger from fragmentation exists.

Ground personnel should also be alert to the negative pressure, or vacuum, which exists at the intake of a running jet engine. Severe injuries or death can result from being sucked into the intake of a jet. Thus, crewmen should be more cautious when working near a running jet than when working near an operating piston-type engine. The danger area in front of a jet is a half-circle, extending 25 feet on either side and slightly to the rear of the engine intake cowl.

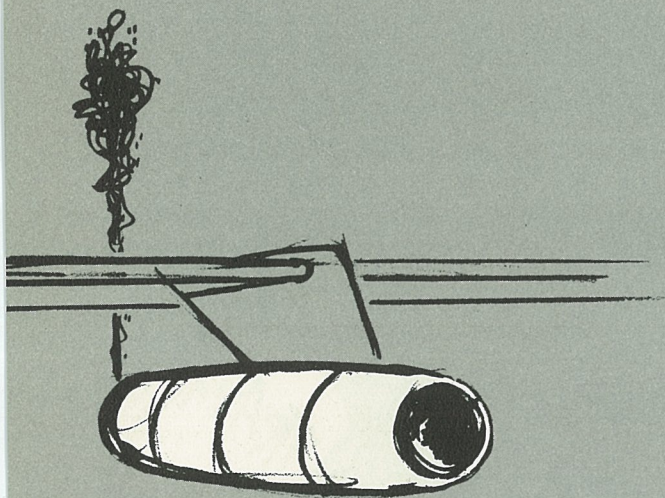
Blast fences will materially reduce the danger area to the rear of a jet engine. Unless blast fences are provided, this danger area extends approximately 200 feet aft of the jet, in a cone 60 feet wide.

Alertness should be accompanied by good housekeeping, when working near *any* operating engines. Gasoline spills, grease and oil spots, or hydraulic fluid leaks can cause slips or falls into danger areas near the engines. Spills and spots should be wiped up with static-free cloths, or covered with sand or commercial preparations immediately.

Special knowledge plays an important part in the safe handling of overheated or burning brakes or wheels. Using CO₂, water, or foam (which has a water base) on overheated or burning brakes or wheels can result in violent explosions, possibly causing severe injuries, and certainly causing extensive damage.

CO₂, water, or foam create sudden chilling and cooling effects, thus setting up contraction and expansion stresses which cause the wheel to fracture and permit the tire to blow. If the magnesium wheel itself is on fire, special precautions should be taken, since burning magnesium is apt to explode when

... SEVERE INJURY
OR DEATH
CAN RESULT



brought into contact with a liquid. Wheel explosions are doubly dangerous, since they are followed, almost simultaneously, by the explosion of the tire.

The only safe extinguishing and heat absorbing agents which may be used are dry chemicals. Dry chemicals, in contact with heat or fire, release fire-smothering gases. They do not chill on contact, and yet absorb heat readily.

If a fire in a wheel definitely exists, and CO₂ must be used, the crewman should stand in front, or to the rear of the wheel, and blanket the area by holding the end of the discharge nozzle four to five feet away from the landing gear. This will lessen chilling effects and subsequent wheel contraction, decreasing the possibility of wheel failure and tire explosion.

Safe maintenance of other components of the landing gear depend mainly on alertness and respect for the hazard present.

Do not examine the tread on inflated or mounted tires with a sharp knife or probe. A weak spot may be struck, causing tire explosion.

Do not attempt to remove the oil filler plug from the landing gear shock strut without first gradually releasing all air pressure through the valve provided for that purpose. The filler plug can become a dangerous missile if released from the strut before all air pressure has been relieved.

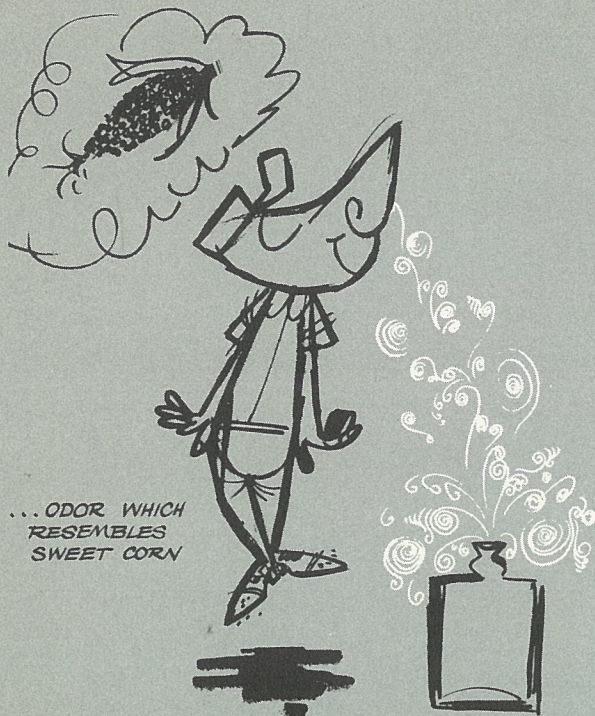
When cycling landing gear for test purposes, make certain that the airplane is properly supported on jacks, and that all personnel in the area are aware that tests are being made.

Make certain, too, that personnel are alerted and clear of the areas under and immediately aft of the wing whenever wing flaps are operated.

TOXIC MATERIALS

Some special knowledge and good practices are important in the use and handling of toxic or flammable fluids. Gloves should be worn, areas well ventilated, and strict precautions against smoking and operation of non-approved electrical equipment followed when using toxic or flammable cleaning agents.





24 10



Maintenance personnel handle these cleaning agents every day. Carbon tetrachloride, trichlorethylene, toluol, benzene, oxalic acid, acetone and acetate, zylene and other dangerous chemicals are used in degreasing parts, cleaning aircraft upholstery, polishing aircraft skins, refueling, and checking fire extinguishing systems. Many of these chemicals are present in trade-name preparations. It is better to take precautions than to guess.

Carbon tetrachloride, one of the most popular and most efficient cleaning agents in common use, is also one of the most deadly. Breathing the fumes of "carbon tet" will cause intoxication, paralysis and, eventually, death. Poisons from it can be readily absorbed through the skin, and serious damage to internal organs may follow. Its use as a fire extinguishing agent is hazardous. Carbon tetrachloride, when heated or on contact with an open flame, releases phosgene, a deadly gas once used extensively in chemical warfare.

Phosgene has a pleasant odor, which resembles sweet corn, and it can be inhaled without excessive irritation. It is especially insidious in that the symptoms from phosgene poisoning do not become apparent until an hour after first exposure.

Another popular cleaner and degreaser, trichlorethylene, also releases phosgene when heated or on contact with open flame. It presents another hazard in that it may become explosive when mixed with strong alkalis. While not nearly as deadly as carbon tetrachloride, it can cause fatalities, if improperly and carelessly used. Trichlorethylene is used in several methods of degreasing . . . vapor baths, atomized spray applications, brush method, flooding and washing, and dipping and wiping.

The vapor bath method gives the most trouble. Since the vapor from trichlorethylene is especially toxic — although less so than the vapor from carbon tetrachloride — special attention should be paid to the proper use of vapor degreasing tanks.

When using vapor degreasing tanks, leave the work in the tank until it reaches the temperature of the vapor, and avoid lowering and raising the work too fast. Removing cold work causes vapor to follow the work from the tank. Fast lowering and raising allows air to be sucked in.

Extreme care should be used in cleaning vapor bath tanks, because most fatalities, connected with trichlorethylene, occur during the clean-out operation.

Toluene, sometimes called "toluol," is doubly dangerous. It is not only extremely toxic, but it presents a serious fire hazard. Its vapors form flammable mixtures with air at all temperatures down to 40°F. Toxic action is mainly due to inhalation of the vapor, which causes severe intoxication. Part of the danger in using it comes from the fact that the user becomes insensitive to its characteristic odor, and is unable to judge its toxic effects.

Acetone and acetate, like toluene, are toxic and flammable, and should be used only where good ventilation is available. Further, since the vapor from these fluids forms explosive mixtures with air at all temperatures down to 3°F, only electrical equipment of the explosion-proof type should be in use where acetone is used or stored.

Xylene, although less toxic than carbon tetrachloride or toluol, is still a fire hazard. It is less volatile than either benzene or toluol.

Chlorobromomethane — "CB" — is an excellent fire extinguishing agent, and is only slightly toxic. However, as with all chemicals, care should be taken to avoid inhalation and splashing.

SAFE ELECTRICAL MAINTENANCE

Special knowledge and extreme care are fundamental to safe electrical maintenance. The electrician who neglects to discharge high voltage condensers, who merely assumes that a circuit is not "hot," who attempts repairs on equipment with which he is unfamiliar, is likely to receive a severe shock, or is apt to start a fire. At best, an expensive piece of equipment may be damaged.

One of the most common causes of fire and shock is the failure to deenergize circuits. Whenever possible, the entire airplane system should be deenergized by removing the batteries and disconnecting ground power units. A "dummy" plug should be installed in the airplane ground power receptacle, to prevent inadvertent connection of ground power units.



... CAUSES
SEVERE
INTOXICATION



... IS LIKELY
TO RECEIVE
A SEVERE SHOCK

Batteries should be removed from the vicinity of the airplane. Connecting a battery while another crewman is working on a part of the airplane circuitry can have serious effects.

Care should be used when moving batteries. If the terminal prongs are allowed to touch nearby metal, the resultant "shorts" will cause sparking and arcs. Fire and explosion may follow if flammable vapor is present.

Explosion can also follow the improper charging of batteries. Batteries should never be charged while installed in the airplane. The battery compartments on some aircraft have inadequate ventilation for this purpose and, if the batteries are charged with the batteries installed in the aircraft, an explosive hydrogen gas and air mixture may be trapped in the battery compartment.

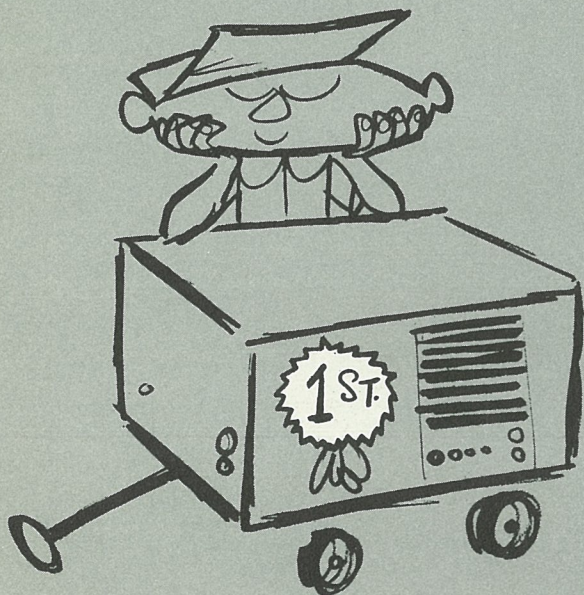
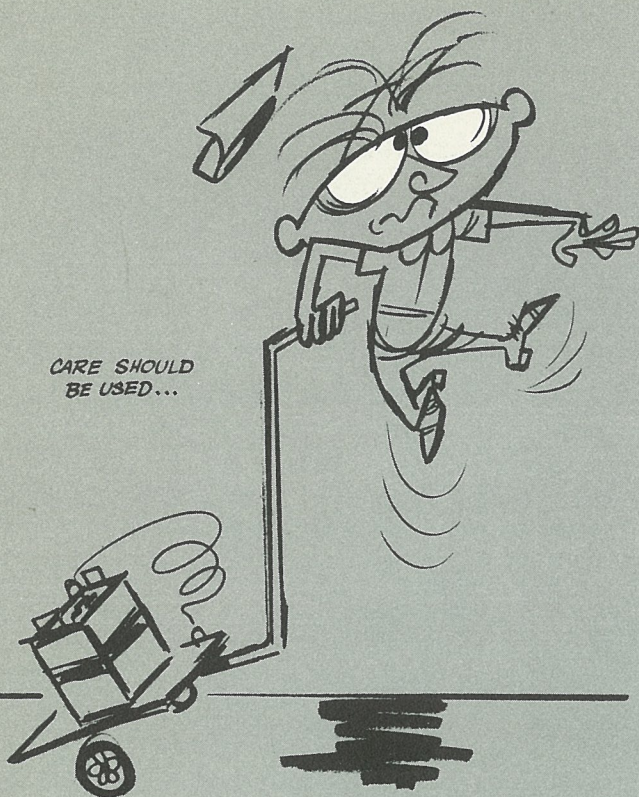
This hydrogen gas and air mixture can also be formed if the battery switch in the airplane is not in the "off" or "ground power" position, when ground power units are connected to the airplane. If the batteries are not removed from the circuit, ground power will charge them, and hydrogen gas will be emitted.

Another common practice which should be actively discouraged is the improper "flashing" of generators in order to reverse polarity. This should be done only with the leads from the battery to the generator firmly connected. The circuit should be opened and closed with the use of a single-pole single-throw switch, placed in the lead from the positive battery terminal to the generator field (A) terminal. Opening and closing the circuit by touching the lead to the battery or generator can cause severe damage to the terminals, or worse, an explosion of the battery.

Ground power units should be kept in first-class condition. Short circuits in the electrical system, arcs across the terminals, sparks, or backfire flames from the exhaust can ignite flammable vapors.

If the entire airplane electrical system cannot be deenergized, the electrical circuit being repaired should be isolated by pulling the circuit breaker or fuse. Only the person working on the circuit should pull the breaker. Relying on someone else can be dangerous.

CARE SHOULD
BE USED...



... SHOULD BE KEPT IN
FIRST CLASS CONDITION

If it is impossible to deenergize the circuit being repaired or tested, take every precaution to prevent accidental contact of control cable, tools, metal parts, and fuel lines. Accidental cross-contact between electrical components and metal parts whenever flammable vapors are present can have serious consequences.

Two men should be present whenever work on "hot" circuits near flammable fluid lines is being done, and adequate fire fighting equipment must be available for immediate use.

Wiring or equipment should never be removed from, or installed on, a "hot" circuit. Positive means should be taken to ensure that the circuit involved is deenergized. New or repaired equipment should be thoroughly bench-checked before installation on the airplane so as to guard against "shorts." This is extremely important where radio or radar components are concerned. These components should be repaired and tested at locations away from the aircraft. Flammable fluids should not be handled within 100 feet of radio or radar antennas whenever either or both sets are in operation.

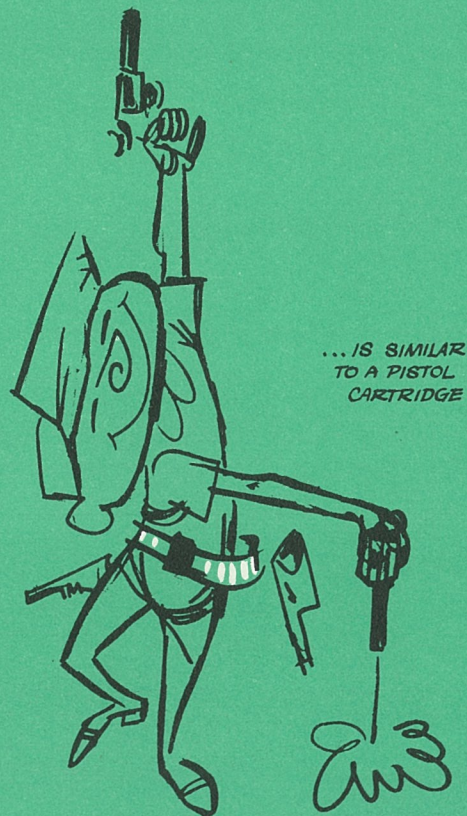
There have been indications that radar transmission can be harmful and even fatal to humans. Avoid standing in the line of transmission, and be as careful near a radar antenna as near the antenna of a radio transmitter, since both can inflict severe burns.

Danger also exists in checking the circuit continuity of the fire extinguishing systems of those aircraft which use either Freon or Chlorobromomethane. Do not attempt to check continuity unless the cartridge and bonnet are properly installed on the extinguisher container and the container is installed in the aircraft. This cartridge is similar to a pistol cartridge and could cause injury or death if accidentally fired.

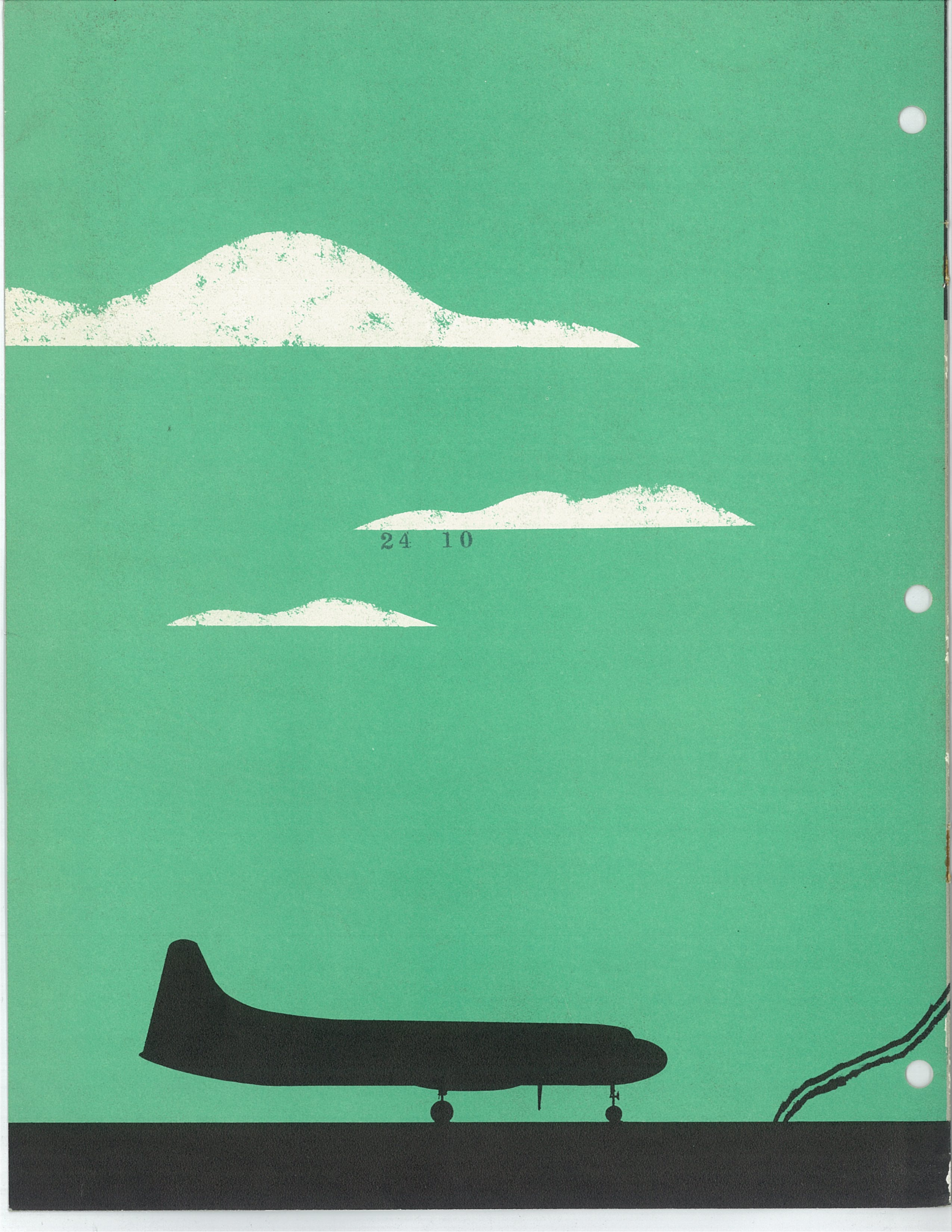
In this article we have discussed briefly some of the areas in which most serious accidents occur and injuries happen . . . fueling, general maintenance, and electrical repair. It is true that some accidents and injuries are the result of component or equipment failure . . . towbars may fail — high-pressure pneumatic lines may give way — hydraulic lines may burst and brakes may slip . . . but any form of accident emphasizes the need for diligence, knowledge of hazards, and precaution.



... ADEQUATE FIRE
FIGHTING EQUIPMENT



... IS SIMILAR
TO A PISTOL
CARTRIDGE



24 10

CONVAIR

Traveler

VOLUME IX

NUMBER 8

JANUARY 1958

THE "880" FUSELAGE



CONVAIR *Traveler*

VOLUME IX NUMBER 8 JANUARY 1958

Manager, Customer Service
J. J. Alkazin

Chief, Transport Service
L. J. Bordelon

Chief, Service Parts
J. Doig

Chief, Service Operations
J. V. Dickson

Chief, Service Publications
H. R. Kennedy

Editor
G. S. Hunter

Writer
Van Hedges

Art Editor
N. J. Rutherford

FOREWORD

From acoustic attenuation to bird-proofing, and from wind tunnel testing to water tank immersion fatigue testing, every fuselage component of the Convair 880 jet transport is undergoing comprehensive tests which will insure a structurally sound airplane.

End result of this intensive testing program will be the world's fastest commercial jet transport, embodying the most advanced safety features known to structural engineers.

Aside from carrying its passengers safely, the "880" will offer such additional advantages as maximum quiet, vibration-free flight, and the ultimate in seating comfort — all of them a result of Convair experience acquired from three-and-a-half decades of manufacturing top quality military and commercial aircraft.

From the moment he enters the airplane through the passenger loading door, which is designed exclusively for pressurized high-altitude aircraft, until the wheels of the airplane touch the strip at his destination, the "880" passenger's flight will be underwritten by structural integrity.

How that integrity is being achieved in the Convair 880 fuselage is told in this issue, supplementing the article in the December *Traveler* which discussed the structural integrity of the wing.

ON THE COVER

Artist Bob Sherman's cover lends dramatic emphasis to the sleek but sturdy design incorporated in the new Convair 880 fuselage.

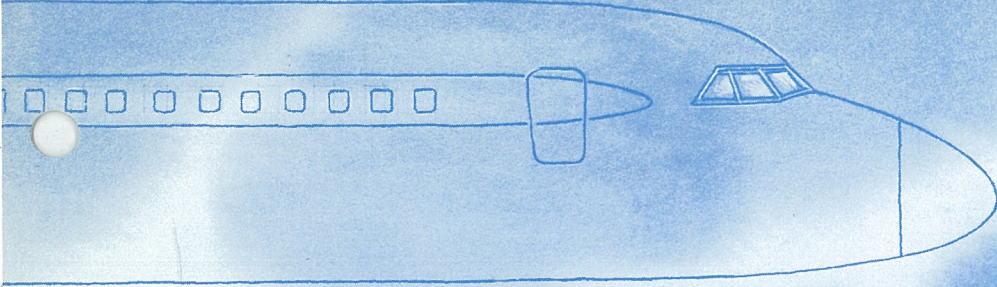


Copyright 1958

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of operation and service published monthly by the Service Publications Section of Convair Customer Service Department in the interest of Convair operators. Communications should be addressed to the Manager of Customer Service Department, Convair, San Diego 12, California.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without specific approval of their cognizant organization.



STRUCTURAL INTEGRITY of the CONVAIR "880" FUSELAGE

The term "fail-safe" has been synonymous with Convair aircraft since the first 240 transport came off the production line in 1947.

Convair has long been aware of the importance of repeated load testing as an essential part of developing the fatigue-resistance of an aircraft structure, and the tests conducted during the past several years on 240 and 340 aircraft have been directed toward that end. Only by extensive fatigue tests can the designer be sure that the preliminary safety measures he has incorporated will actually be effective.

Developments in the "880" structural test program to date include preliminary testing of cabin windows and windshields, and structural and crack propagation tests of the fuselage structure. High- and low-speed wind tunnel testing of five scale models was also conducted to determine air loads and their distribution.

Although subassembly tests are the principal tool of fatigue investigations, a structure without any fatigue critical areas can be guaranteed only by fatigue tests of the structure as a whole. Such tests provide a means of more accurately reproducing all the stresses that act simultaneously within the airframe.

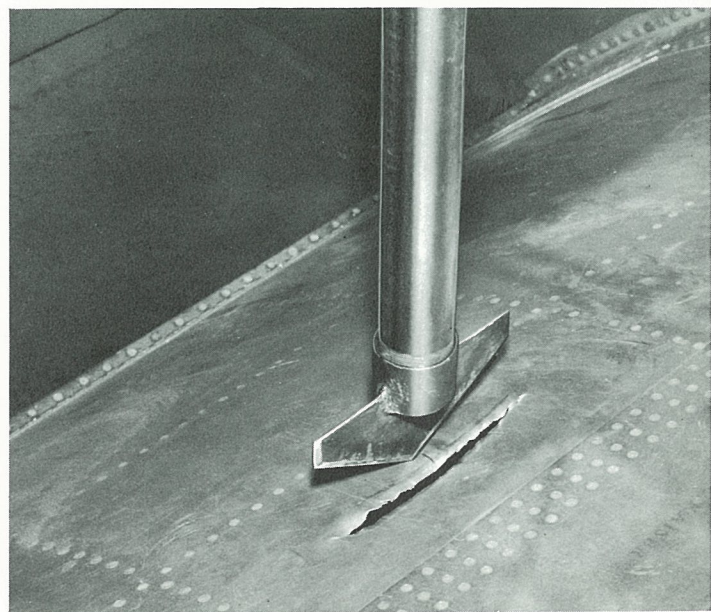
In recognition of this fact, a comprehensive "880" fuselage test will be conducted in a water tank with a complete fuselage and stub wing assembly. To this specimen will be applied many cycles of combined pressurization and flight loads, with landing loads interspersed between programs of flight cycles.

It is expected that skin stresses in the fuselage of the Convair 880 will be low enough to preclude fatigue cracks throughout the life of the airplane.

Nevertheless, Convair, being aware that fatigue is not the only phenomenon that may start a skin rupture, has undertaken an extensive test program to demonstrate that such ruptures, if they should occur, will not result in a major failure under normal operating conditions prior to their detection by inspection.

A series of fail-safe tests were conducted in which various members were cut, and loads applied to demonstrate that the "880" structure or section considered retained its integrity. Emphasis was placed on very low rates of crack growth. In no case did explosive failure occur in any of the fuselage frames and panels tested.

The most drastic test involved dropping a steel javelin through the fuselage skin of a test section under pressure. Although a substantial cut was made, there was no evidence of additional structural failure.



A test section of fuselage skin under pressure is subjected to the javelin test.

Research in sound suppression is currently centered in the new Convair Acoustics Laboratory, where Convair engineers are developing the quietest passenger cabin possible for the "880." The tests are being conducted to determine the selection of proper skin panel damping materials and methods, and to measure the differences in sound decay with and without damping materials.

The philosophy of employing acoustic mass attenuation by applying thick skins (.063 inch to .100 inch) to the fuselage has been utilized. In one of the laboratory units at the Convair acoustical facility, a test panel is placed in an opening provided in the partition between a reverberation chamber and an echo-free chamber.

Electronic noise generators, amplifiers and loudspeakers project the required volume and frequency of sound into the reverberation room. The sample under test reflects, transmits, or absorbs this sound in varying degrees. The amount of noise that escapes through the sample into the anechoic chamber is measured.

All kinds of noise — the complete audible spectrum from 15 to 15,000 cycles per second, or any desired single frequency or band of frequencies — are projected into the reverberation room through loudspeakers. Its modular concrete walls break up

standing sound waves and thus create a uniform audio field in which specimens can be tested. Almost all the sound projected into the room is reflected by walls, ceiling and floor.

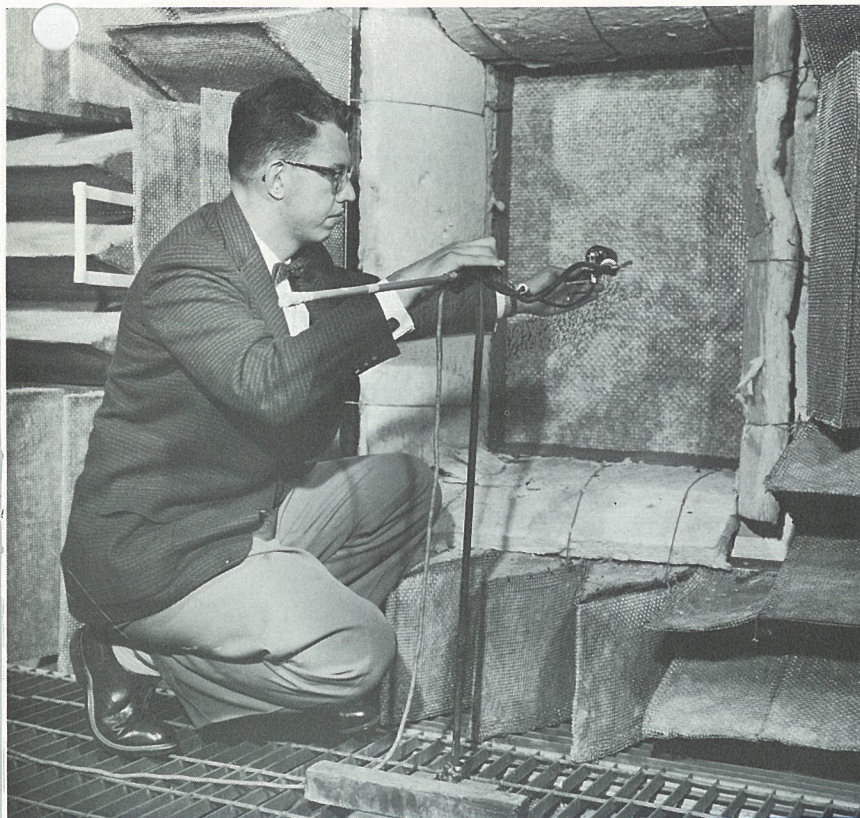
In the anechoic chamber, on the other side of the test panel, reflected sound is reduced to an absolute minimum. Sound radiates in all directions from a source, and the glass fiber wedges, which form the interior surfaces of the room, trap and absorb any sound transmitted through the test specimen into the chamber. The fiber itself attenuates high frequencies, and the wedge shapes, into which it is formed, absorb the low frequencies. A removable floor grating allows engineers to walk into the chamber to set up tests and instrumentation.



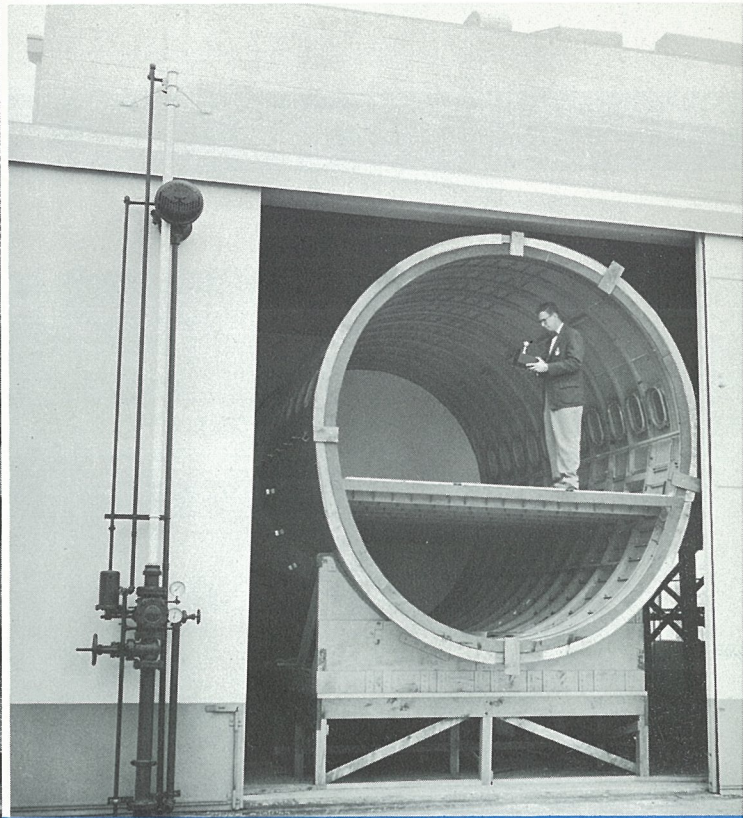
Research in sound suppression and noise measurement takes place at the Convair Acoustics Laboratory.



A specimen section of the "880" cabin, later to be subjected to strenuous fail-safe tests, nears completion.



Noise escaping through a fuselage test panel is measured in the Acoustic Laboratory's anechoic chamber.



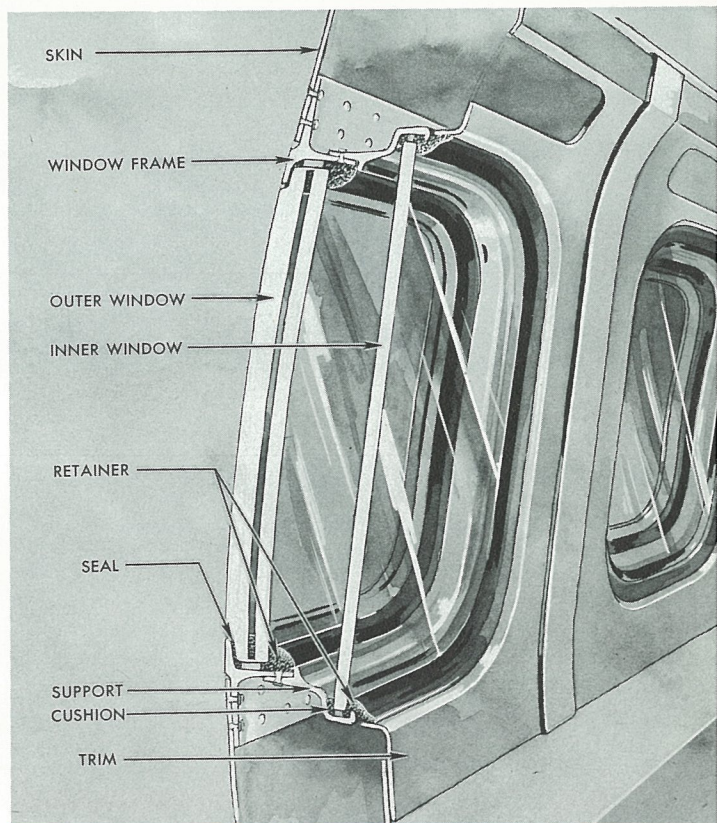
A full-scale, 19-foot specimen of the cabin constant section awaits acoustical testing in the reverberation chamber.

A window for an "880" jet transport can be mounted in the test opening and subjected to the "white" noise (all audible frequencies) produced by the CJ-805 turbojet engines, electronically simulated. Instruments in the anechoic chamber then can measure accurately the amount of jet engine noise each window would admit to the "880" passenger cabin.

Two panes of stretched Plexiglass 55, separated but formed into a single outer unit, plus an inner window pane mounted in rubber, make up the window itself. Structural load can be absorbed by either of the two outer panels.

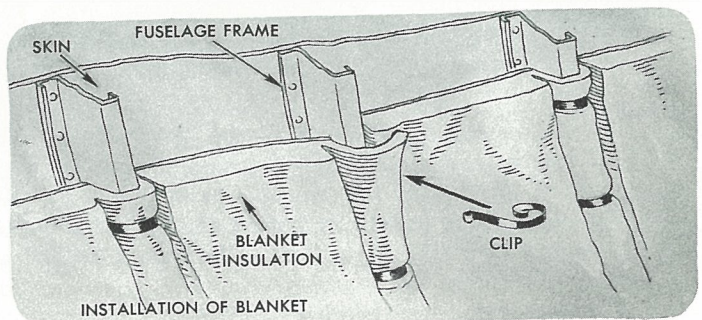
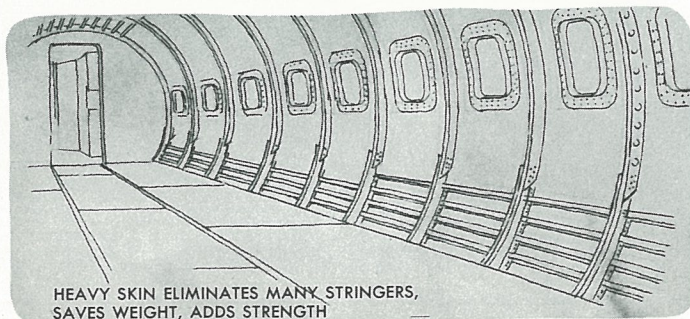
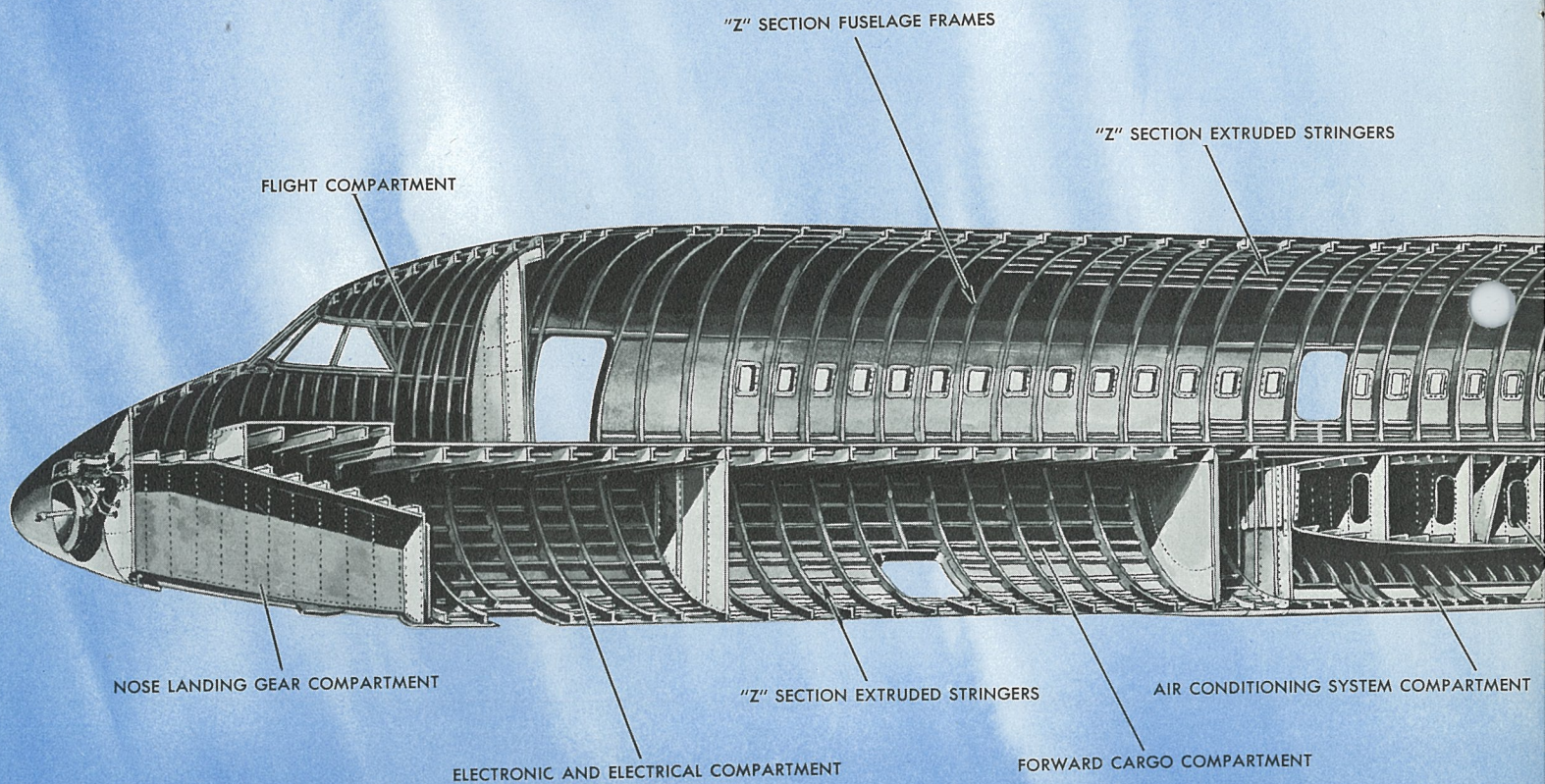
Other preliminary testing of cabin windows has been completed. Window installations were subjected to structural tests involving forces such as shear, torque, tension, and compression.

Placement of windows in the "880" allows two windows per seat row on each side, or four for each cabin bay. Windows are approximately 9 x 12½ inches in size, and the frames are a single-piece aluminum alloy forging. Support for the frames is supplied by the heavy skin, which eliminates the need for longerons around windows.



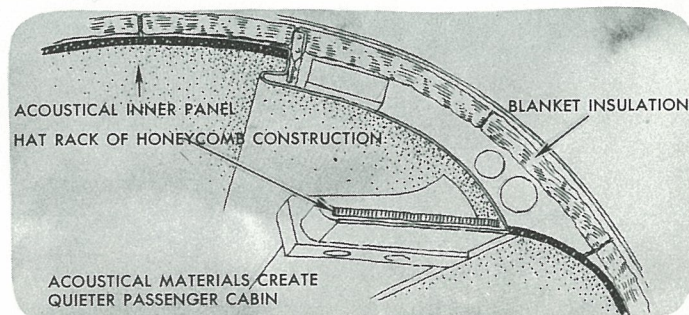
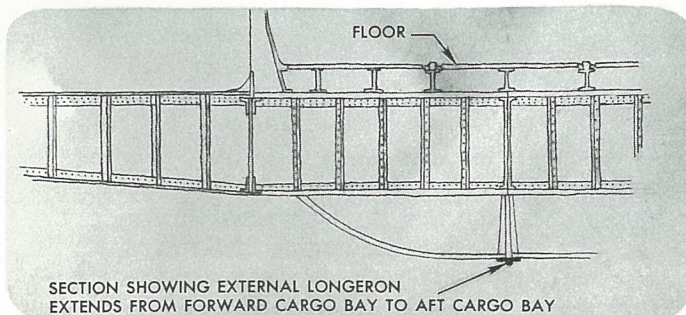
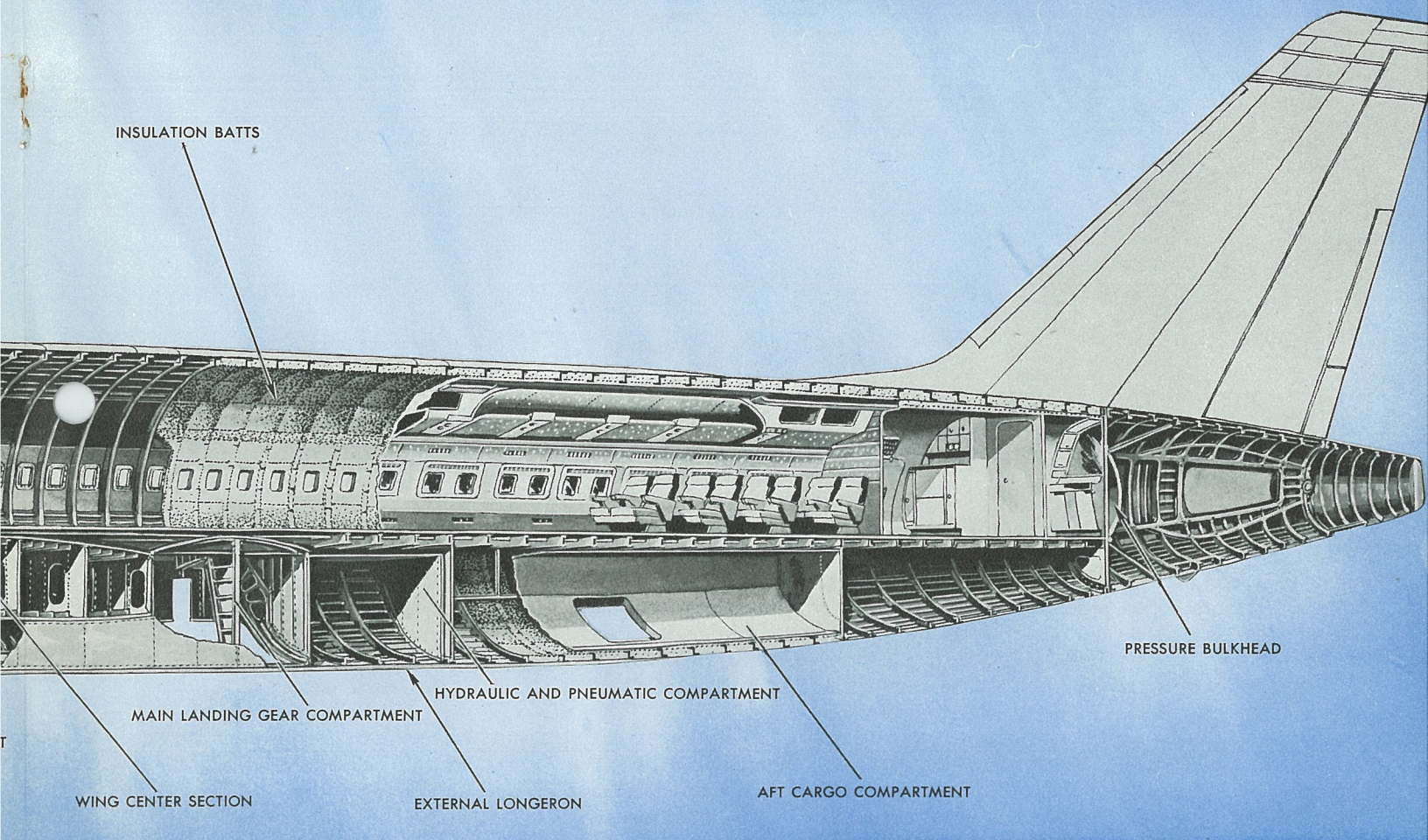
Typical Cabin Window Installation

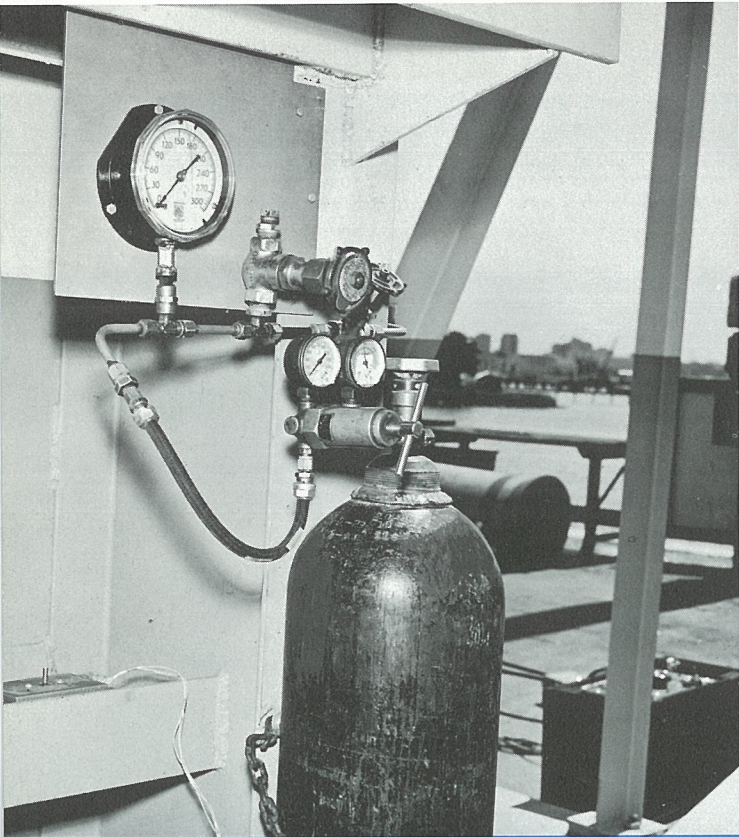
SECTIONAL VIEW SHOWING STRUCTURAL DETAIL of the



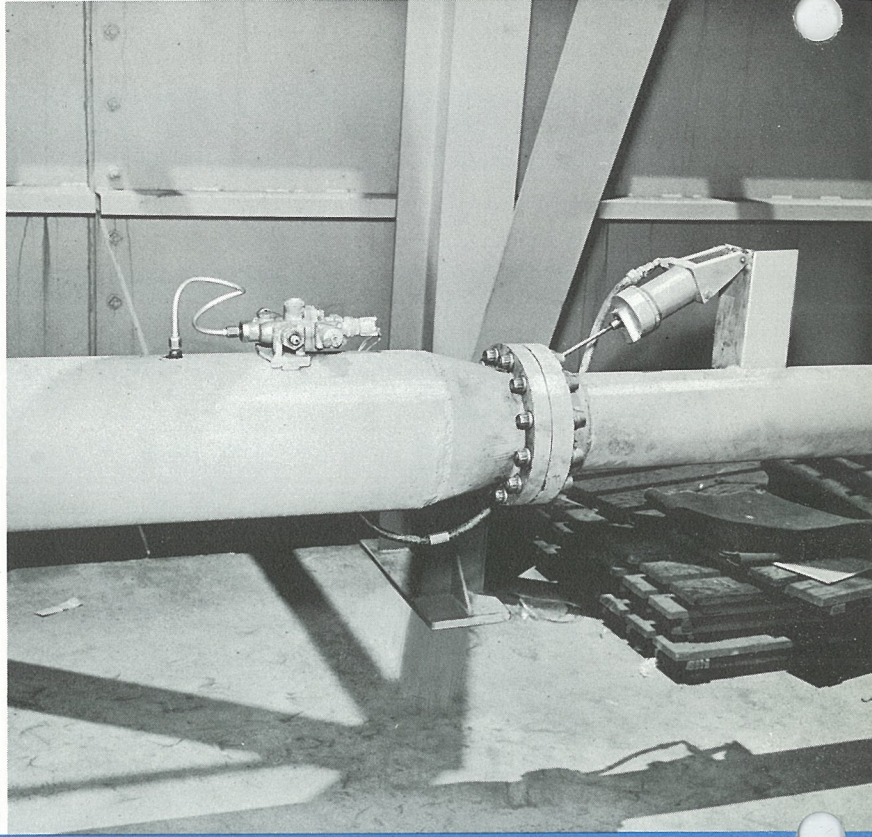
e CONVAIR "880" FUSELAGE

The structural soundness of the Convair 880 fuselage is exposed in detail in this over-all nose-to-tail sectional drawing.





Nitrogen under pressure is used as a propellant in wind-shield bird-proofing tests employing an air gun.



A solenoid valve is triggered to release the chamber pressure which accelerates the chicken through the gun barrel.

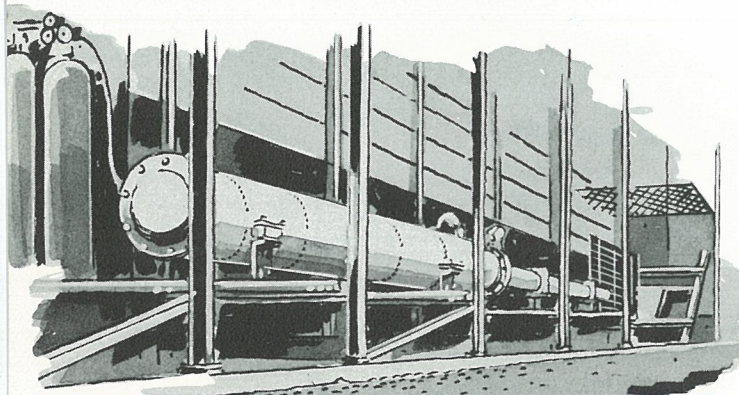
The net result is that heavier skin in the "880" fuselage will reduce the amount of acoustical tape, glass fiber, and other soundproofing agents required, and will insure added protection against explosive decompression with no significant weight penalty.

Preliminary bird-proofing tests on the main wind-shield have also been completed. Purpose of these tests was to satisfy the bird-proof strength requirements of the windshields, which will be incorporated in the "880," and to prove the structural integrity of the windshield panels. Actual tests involved use of an air gun installed at the Convair Structures Ramp Facility in San Diego.

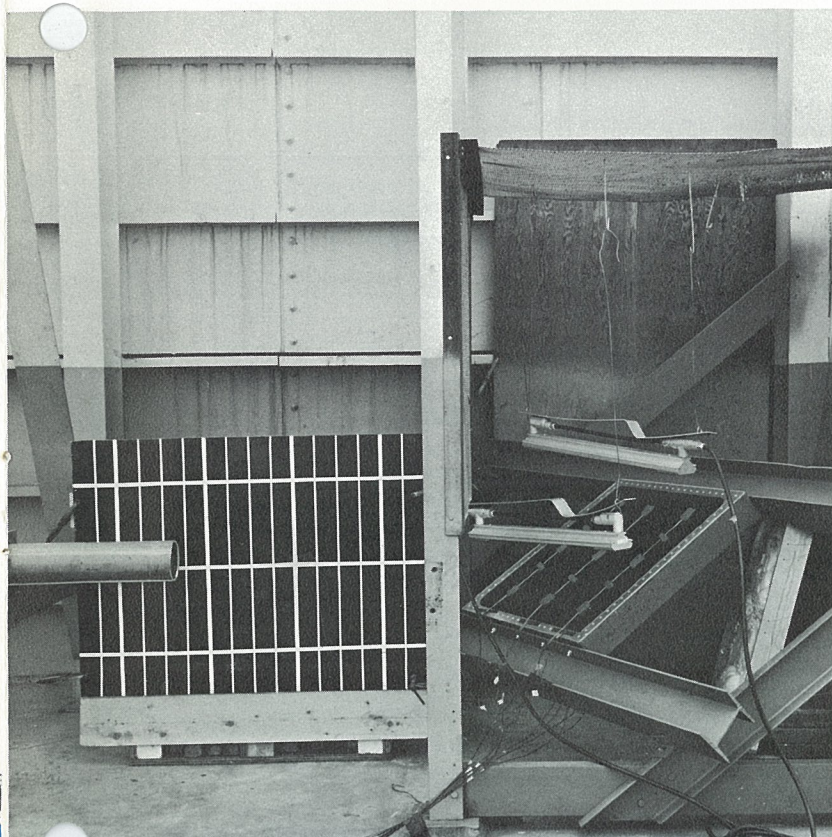
A chicken weighing approximately four pounds was chloroformed just prior to each test, and encased in a transparent polyvinyl alcohol bag. The bag containing the chicken was inserted in the barrel of the gun at the breech. Mylar diaphragms of the proper thickness were set in a recess between the chicken and a pressure chamber, to which the barrel was bolted.

Nitrogen under pressure was bled into the pressure chamber until the desired pressure was reached. A solenoid valve was triggered, allowing this pressure chamber to activate a knife-ended plunger which ruptured the diaphragm and released the chamber pressure to accelerate the chicken down the barrel.

Windshields were mounted in a frame which was located transversely to the desired position in front of the gun. The speed of the chicken was computed by analysis of high-speed films taken at the end of the barrel while the chicken was traveling between gun and windshield. The distance it traveled per frame was read from a calibrated board in the background, and the speed of the film was determined by timing marks made by a pulse generator. The gun was capable of firing the bird at velocities far above the cruise speed of the new airplane.



Windshield bird-proofing tests are conducted at the Convair Structures Ramp Facility.



Chicken's speed as it contacts the frame-mounted test windshields is computed by analysis of high-speed films.

Advanced bird-proofing tests on center and main windshields have just been completed, with final selection of the "880" windshield to be made from panels tested.

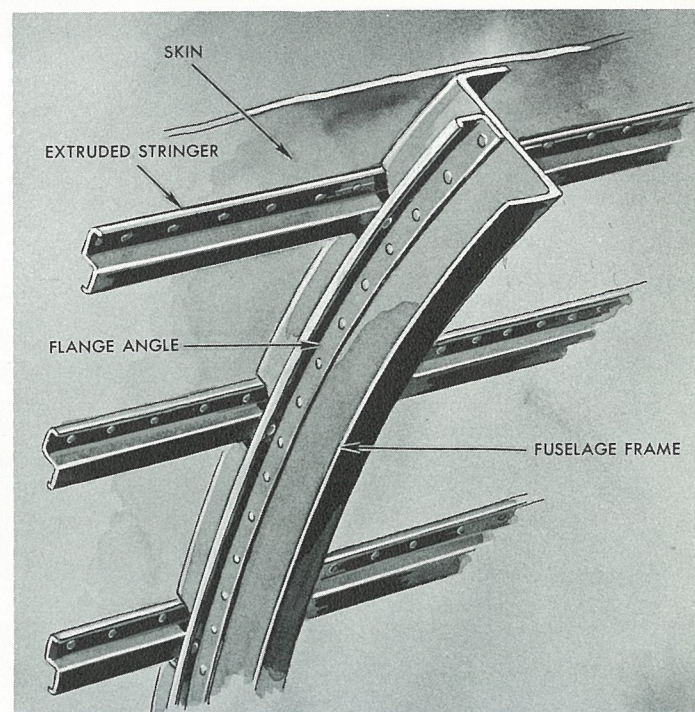
These various tests have given Convair design engineers the knowledge to design a passenger cabin for the high-speed, high-altitude Convair 880 — a passenger cabin that has insured protection against structural fatigue which might otherwise cause explosive decompression.

Aluminum alloy 2024, noted for its superior resistance to crack propagation, is used throughout for the fuselage skin. Its gauge ranges from .063 to .100. The minimum skin gauge in the pressure cabin is .063, and the maximum gross hoop tension stress is 8500 psi at 8.2 psi cabin pressure. Above the cabin floor line where the windows and most openings are located, the heavier gauges will be used.

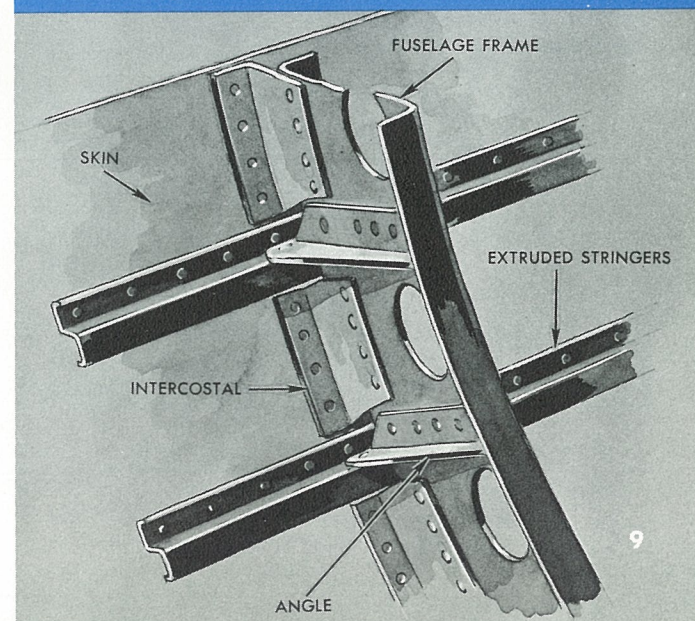
Use of the heavier skin also eliminates the need for stringers over a considerable area. This will result in lower pressurization-induced stresses, and in weight reduction.

Typical stringers are .050 gauge, and generally are $\frac{7}{8}$ -inch deep, extruded 7075 aluminum alloy Z-sections. Stringers numbered 9 to 17, approximately centered on the floor line, are 2024, and spacing is approximately six inches. Below this region, spacing is nine inches, except in areas fore and aft of the wing. Above the area of greatest radius, stringers are eliminated up to a point varying from approximately 15 to 40 inches from the top center line. Width of stringer installation in this top area is greatest over the wing.

Fuselage frames in the "880" are stretch-formed 7075 Z-sections, and a typical frame is $\frac{3}{8}$ inches deep and of .050 gauge.



Typical Fuselage Frame and Stringer Intersections



The aft pressure bulkhead is located forward of the horizontal stabilizer so as to eliminate sealing problems, because this surface is adjustable.

At the plane of symmetry on the fuselage bottom, a heavy built-up keel member insures structural continuity in the region where the normal fuselage structure is interrupted by the wheel wells and, to a lesser extent, by the wing center section.

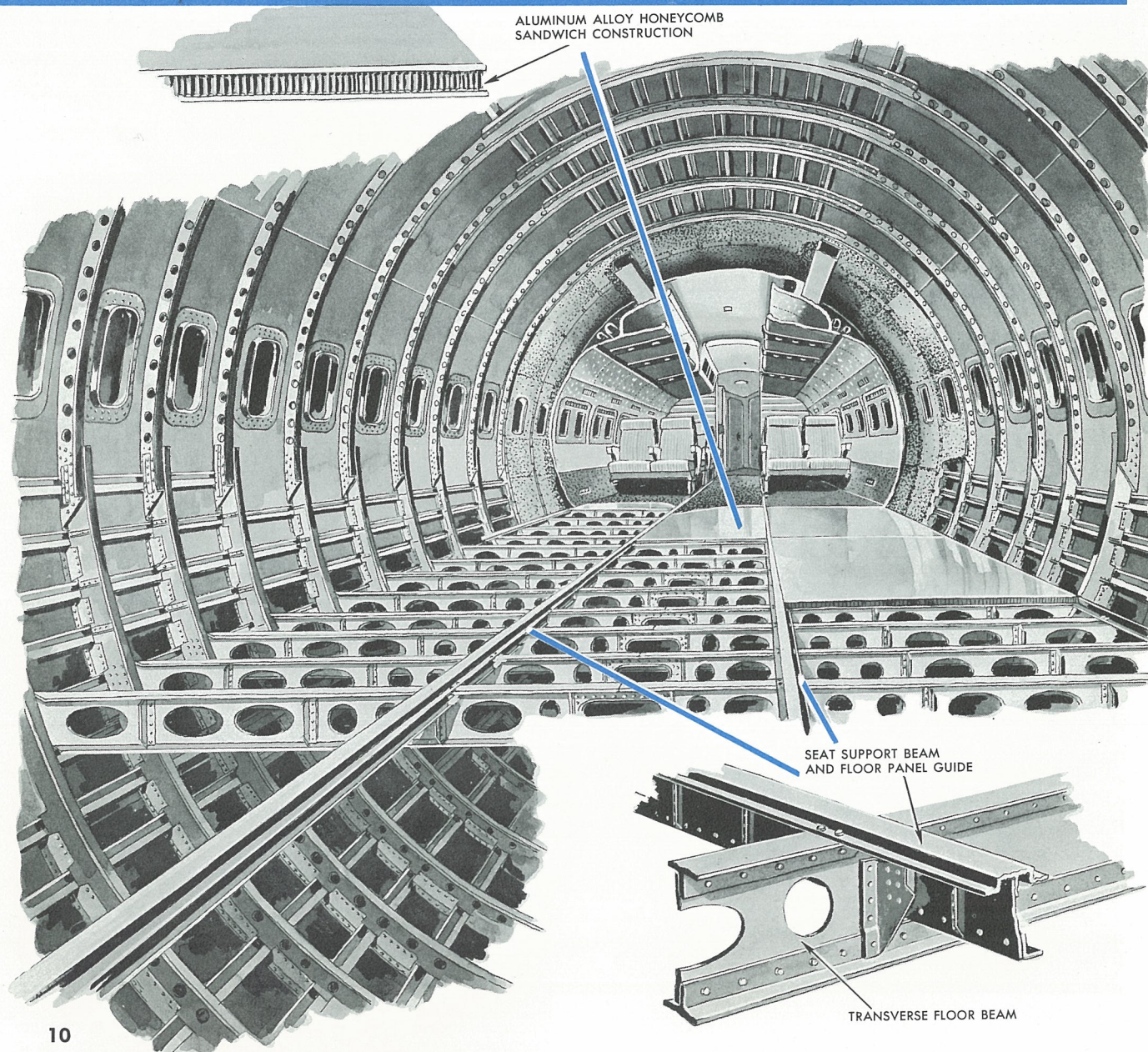
The under fuselage compartmentation aft of the weather-mapping radar nose includes the nose wheel well, the electronic and electrical sections, the forward cargo area, the air conditioning system (under

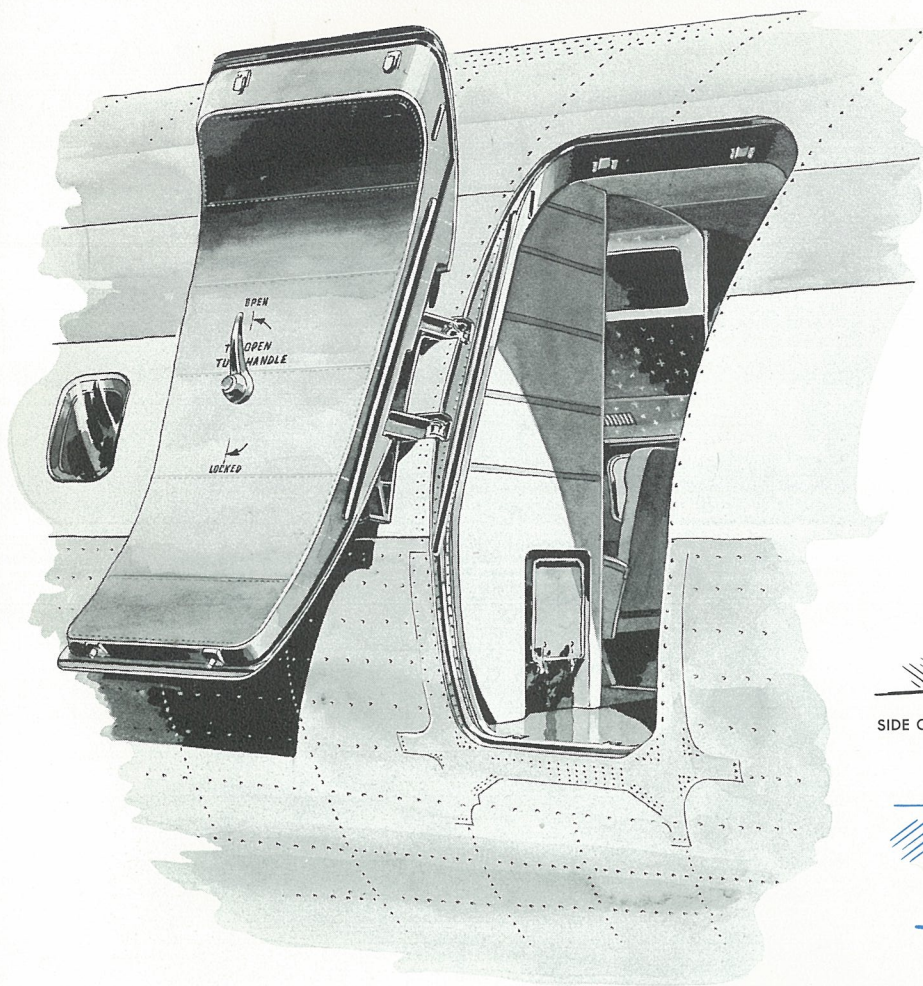
the wing center section), the main landing gear wells, the hydraulic-pneumatic section, and the rear cargo compartment, in that order.

The cabin floor of aluminum alloy honeycomb sandwich construction is supported by transverse floor beams at each frame. A more resilient belly structure for wheels-up landing is achieved by the elimination of vertical members to support these floor beams. Use of vertical members could transmit shock to the cabin floor structure at the time of a wheels-up landing.

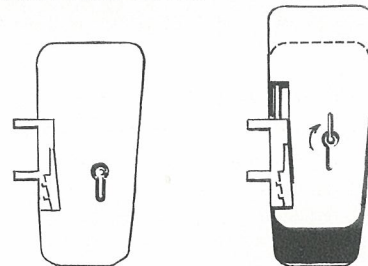
Another feature to be incorporated in the Convair 880 fuselage includes a passenger loading door whose

DETAIL OF CONVAIR "880" FLOOR STRUCTURE



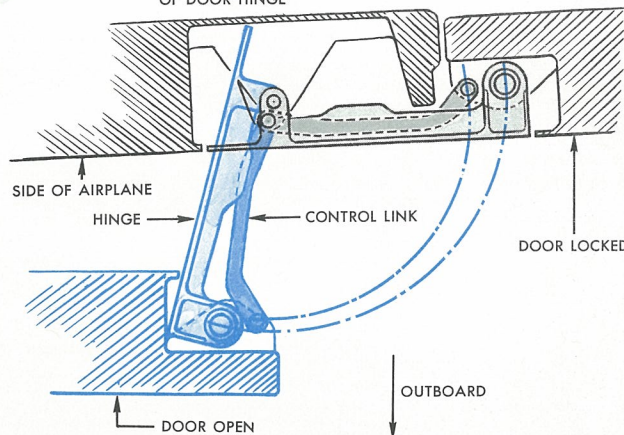


PASSENGER LOADING DOOR
IN FULLY LOCKED POSITION



HANDLE, WHEN ROTATED TO OPEN POSITION,
RAISES DOOR SO THAT IT MAY BE OPENED

BASIC MECHANICS
OF DOOR HINGE



FAIL-SAFE DOOR DESIGN for the "880"

mandatory design requirements incorporate adoption of the following safety features:

1. The door is of the plug-type, and does not depend on latches to restrain it from outward movement under any flight or cabin pressure condition. Increasing cabin pressure acts to increase the security and retention of the door.

2. The door hinges are designed to stow the door externally, well out of the entrance, in the open position.

3. The door can be opened from inside or outside, even though persons may be crowding against door from the inside.

4. The means of opening is simple, and is so arranged and marked that the door can be readily opened, even in darkness.

5. Provisions are made to minimize the possibility of jamming the door as a result of icing conditions, seal vulcanization, or fuselage damage due to minor crash landing. This is required because openings normally used for passengers also serve as emergency exits.

6. The door is capable of being operated by one person under any wind condition normally encountered in ground operations.

The "880" door is of an upward-sliding, side-hinged configuration. The edge adjacent to the hinge and the opposite edge are slanted to form a wedge-shaped door narrower at the bottom than at the top. Shear ledges along each edge of the door fit in recesses in the opening frame and are the load-carrying members. A mechanism incorporating a door weight counterbalance spring, actuated by the handle, provides the initial upward motion of the door. Hinges located at the forward edge of the door control the door during opening.

To open, the operator rotates the handle to the "open" position. This slides the door upward parallel to the hinge line. In this position, the shear ledges along the aft door edge will clear the mating recesses. The door can then be swung open, allowing the shear ledges adjacent to the hinge to rotate out of their mating recesses.

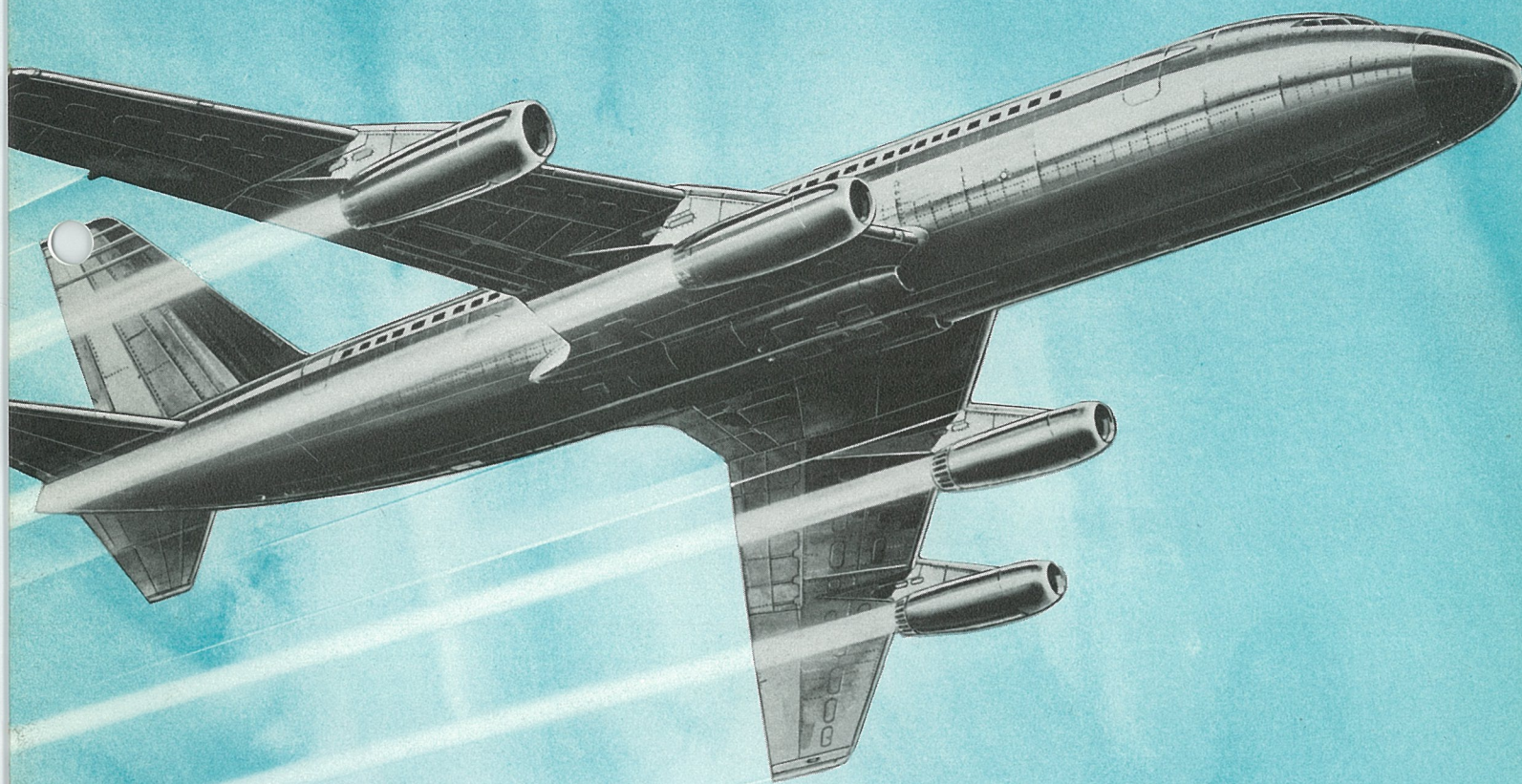


CONVAIR *Traveler*

VOLUME IX

NUMBER 9

FEBRUARY 1958



AIR CONDITIONING and
PRESSURIZATION SYSTEM for
the CONVAIR 880

CONVAIR

Traveler

VOLUME IX

NUMBER 9

FEBRUARY 1958

Manager, Customer Service
J. J. Alkazin

Chief, Transport Service
L. J. Bordelon

Chief, Service Parts
J. Doig

Chief, Service Operations
J. V. Dickson

Chief, Service Publications
H. R. Kennedy

Editor
G. S. Hunter

Writer
Van Hedges

Art Editor
N. J. Rutherford

FOREWORD

The Convair 880 air-conditioning and pressurization system is designed to provide "living-room" comfort to every passenger aboard. From takeoff time to landing, a cabin atmosphere of ideal temperature, pressurization, and humidity will prevail. Regardless of outside weather, "880" passengers will be assured of a maximum ground temperature of 80°F, and 75° in flight.

The pressurization system will provide sea level comfort at altitudes up to 20,000 feet; cabin air pressure at 40,000 feet will be the same as that which exists at 8,000 feet. Automatic controls will prevent any sudden changes in pressurization during rapid climb and descent. A vapor cycle Freon refrigeration unit will maintain humidity at a level compatible with temperature.

How these systems will operate and the conditions under which they will function are discussed in this issue.

ON THE COVER

Depicted in high-altitude flight by Artist Bob Sherman, the Convair 880 will afford maximum comfort and safety with a thoroughly coordinated air conditioning and pressurization system.

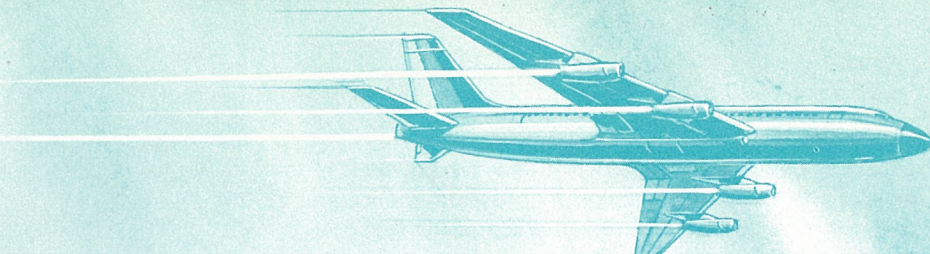


Copyright 1958

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of operation and service published monthly by the Service Publications Section of Convair Customer Service Department in the interest of Convair operators. Communications should be addressed to the Manager of Customer Service Department, Convair, San Diego 12, California.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without specific approval of their cognizant organization.



AIR CONDITIONING and PRESSURIZATION SYSTEM for the CONVAIR 880

The Convair 880 air conditioning and pressurization system is designed to supply all occupied compartments of the airplane with an air flow of 160 pounds of air per minute at sea level, and 120 pounds per minute at 35,000 feet.

The air conditioning system supplies circulating fresh air, heated or cooled as conditions require. A complete change of air is delivered to the cabin every 2½ minutes and to the flight deck every minute.

The cabin maintains a temperature of 75°F in flight under all ambient temperature conditions and a maximum of 80°F on the ground. At all outside air temperatures . . . whether 100°F or -40°F . . . the air conditioning system keeps passengers comfortable without unpleasant air surges or annoying drafts.

Each passenger has a silent individual cold-air inlet to provide direct airflow, if desired. All air entering

the cabin through the outlets below the hatracks is discharged through side panel floor exit ducts, and then is dumped overboard.

Heating and cooling of baggage compartments, and electrical and electronic equipment is also provided by the air conditioning system.

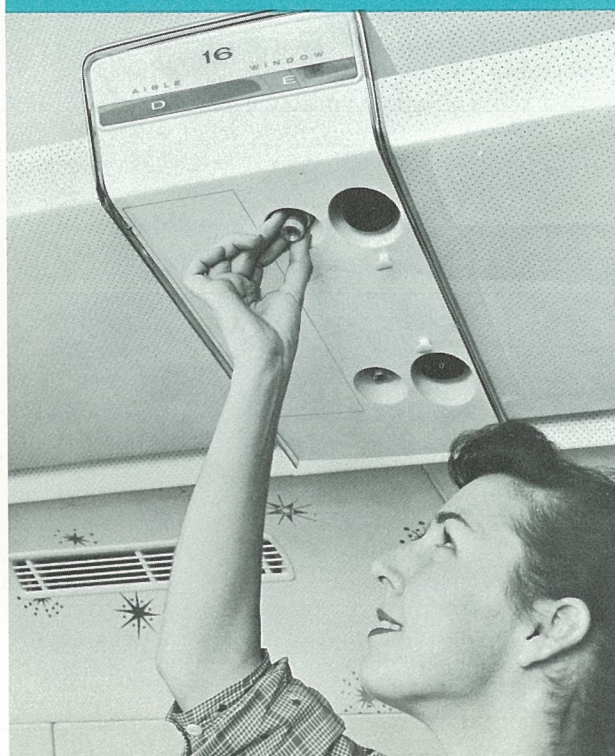
The Convair 880 holds a sea level cabin altitude up to an airplane altitude of 20,000 feet, and an 8000-foot cabin altitude up to an airplane altitude of 40,000 feet. The maximum normal cabin differential operating pressure is $8.2 \pm .10$ psi. In event of failure to both cabin pressure regulator sections of the out-flow valves, the relief valves will relieve at a differential pressure of $8.50 \pm .10$ psi. Signal lights on the flight deck control panel will indicate the respective valve failure, and a warning horn will sound when cabin altitude exceeds 10,000 feet.

Presetting of the rate of change of cabin pressure control permits operating at rapid rates-of-climb and descent with a minimum rate-of-change of cabin altitude. Flow is maintained automatically against all normal loads imposed upon the system by the ever-changing demand for pressurization and ventilation.

Surges in the cabin pressure altitude during takeoff or landing will not exceed the normal regulated rate-of-change by more than 150 fpm. The cabin pressurization system will prevent negative cabin differential pressures in excess of 10 inches of water, at airplane rates of descent of 25,000 fpm with the normal cabin air source shut off. The cabin pressurization system will accommodate a rate-of-climb of 3000 fpm and a rate-of-descent of 7000 fpm, while maintaining cabin pressure schedule tolerances.

The rate of cabin pressure change is selectable from 2000 ± 200 fpm to 65 ± 35 fpm. The nominal calibration is 500 fpm ± 10 per cent. Deviation from selected cabin pressure rate-of-change during transient conditions will not be greater than ± 25 fpm.

Individually-controlled cold-air inlets provide direct air flow as desired.



The basic air conditioning system is composed of two separate and independent subsystems, pneumatically-driven by bleed air from the four CJ-805 engines. Each subsystem consists primarily of a ram air supercharger (bleed air turbine-driven compressor), an air-to-air heat exchanger, and a vapor cycle Freon refrigeration unit.

An electrically-driven vapor cycle Freon system is available as an optional installation. This system is basically the same as the pneumatic-drive system except that the freon condenser fan and compressor are driven by an electric motor. Also, in the electrically-driven system, an electric heater is employed in the cabin and flight deck main distribution line for ground heating.

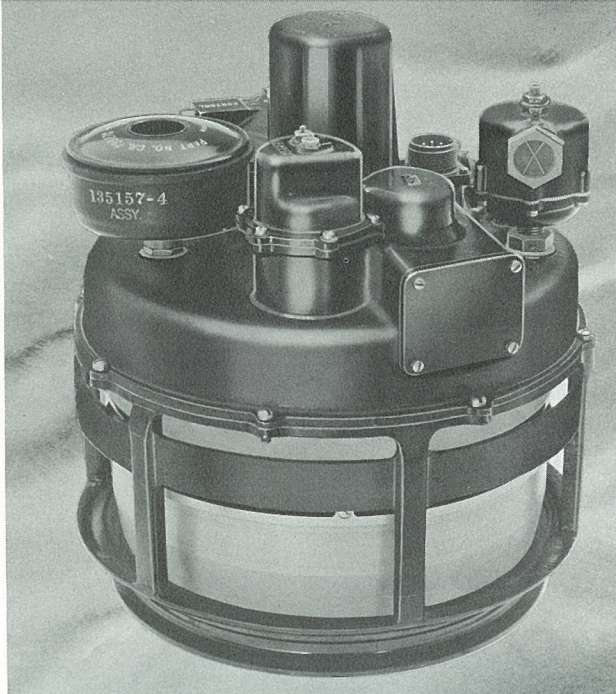
Under normal operation, in either the pneumatic or electrically-driven systems, one subsystem supplies the air for the cabin, and the other supplies air for the flight deck. Each subsystem is controlled separately, but if one subsystem fails, the other will supply adequate air conditioning and pressurization for both the cabin and flight deck for the continuation of the flight.

A vapor cycle Freon system provides full cooling in flight without increasing the load on the superchargers that provide the cabin pressurization and ventilating air. This becomes increasingly important in high-speed jet aircraft, because cooling is required during a greater portion of the flight regime.

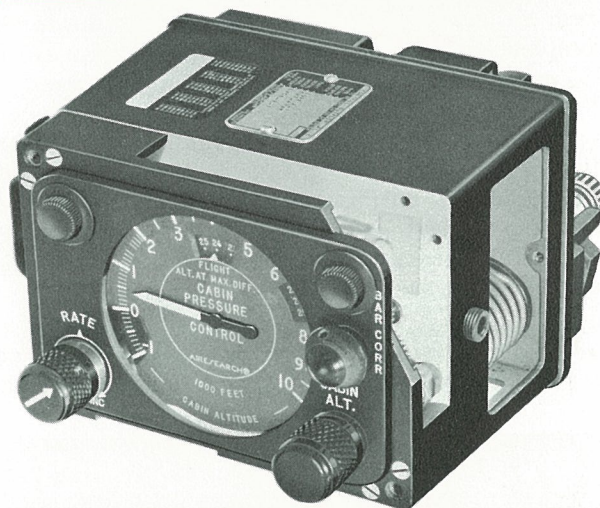
The vapor cycle refrigeration unit is essentially a Freon loop system that uses Freon 114 (dichlorotetraethane), a stable, nontoxic fluid. The Freon loop contains a compressor and drive, condenser, evaporator, and the necessary control valves. With this type system, moisture, in the form of either liquid or fog, will not enter the cabin. Moisture present in the air passing through the Freon evaporator will condense on the cool surfaces of the evaporator. This condensation forms large drops which can be easily drained and dumped overboard.

During ground air conditioning operations, the vapor cycle system effects a rapid pull-down of cabin air temperature without the use of large external cooling carts. Ground operations are further improved by recirculating part or all of the cool cabin air through the Freon evaporator instead of dumping it overboard. Consequently, the load on the system and the time required to lower the cabin temperature are reduced.

The entire Freon loop system is packaged so that the unit can be removed for maintenance and servicing by removing three bolts and disconnecting three ducts.



Above: Cabin pressure regulator outflow valve.
Below: Cabin pressure regulator outflow control and indicator.



Cabin pressurization is automatically regulated by two cabin pressure regulator outflow relief valves, and a cabin pressure outflow control and indicator. One pressure regulator outflow relief valve is located in a pressurized area at the aft end of the airplane; the other is located in a plenum chamber containing electrical equipment, at the forward end of the airplane.

Each valve is a dual purpose outflow and safety valve to provide both cabin pressure relief and vacuum relief. In addition, each valve operates both mechanically and electrically.

Each outflow safety valve includes a filter, pneumatic relay, pressure relief mechanism, and an electro-mechanical actuator. The venturi serves as a vacuum sink for the pneumatic relay to provide power to operate the system at low cabin to ambient pressure.

The pressure balanced poppet-type outflow valve is operated either pneumatically by a diaphragm, or electrically by an electromechanical actuator, with switches located on the flight deck panel.

Each valve functions independently, offering an extra margin of protection. In the event of malfunction, the valves are designed to fail safely in the closed position so that one valve failure cannot result in cabin depressurization. Should one unit fail, the remaining outflow valve is capable of maintaining normal control of cabin pressure. A flow equalizer control is incorporated to divide the total cabin flow through each valve.

The forward outflow valve, located in the electrical compartment below the cabin floor, exhausts cabin air overboard after it has been utilized for cooling the electronic and electrical equipment.

Either of the pressure regulator outflow relief valves is capable of maintaining normal cabin pressure schedules as selected by the pilot.

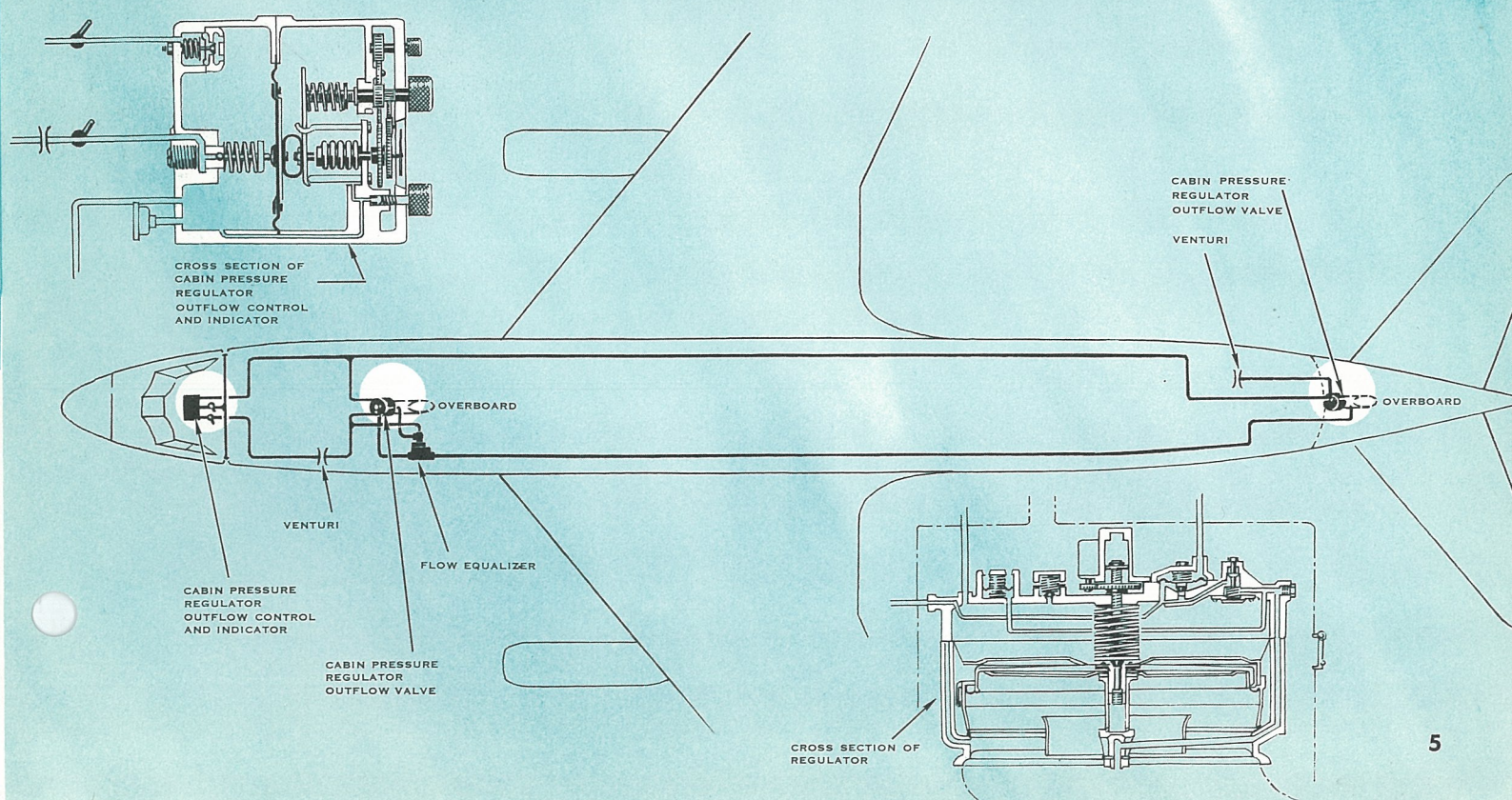
Under normal operations, 50 ± 10 per cent of the total airflow passes through the outflow unit of each pressure regulator outflow relief valve. The outflow valve control incorporates a cabin altitude selector knob and indicating dial, permitting the selection of any cabin pressure altitude within the range of

—1000 feet to +10,000 feet. During isobaric operation (constant cabin altitude), the variation in cabin pressure altitude will not exceed ± 150 feet at a maximum rate-of-change of 50 fpm.

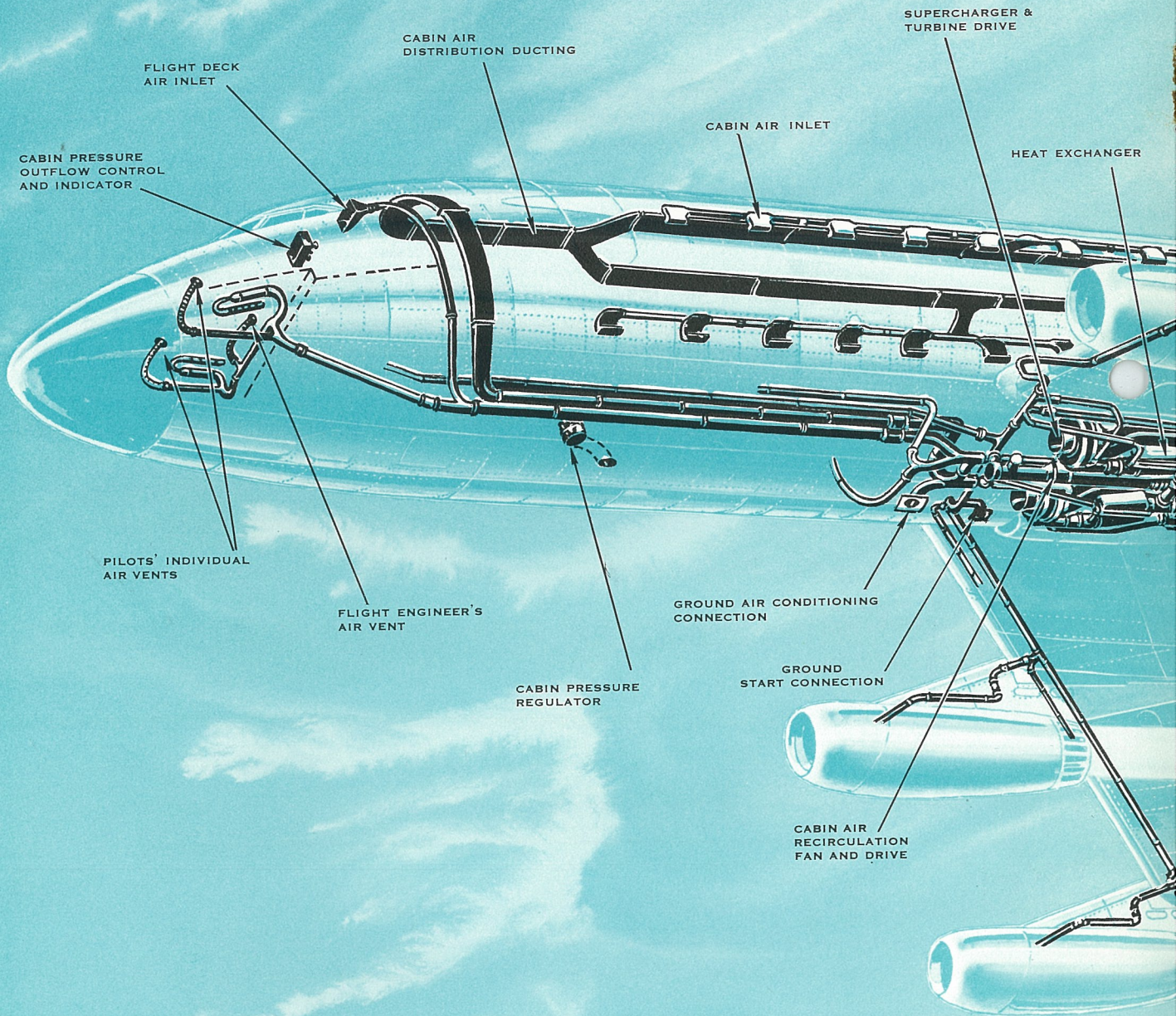
Controls and instrumentation on the flight deck panel permit preselection of cabin pressure change rates and cabin pressure altitudes. Cabin differential pressure and altitude gages give a visual indication of the pressurization system operation. A secondary means is provided for cabin pressure regulation by two toggle switches which individually control each regulator by means of an electric motor mounted on each outflow valve. The outflow valve control incorporates a barometric pressure adjustment to correct for airport barometric pressure variations at time of takeoff and landing. On landing, a landing gear switch energizes the electrical actuators on the outflow valves to open the valves and release cabin pressure. During takeoff, the procedure is reversed.

In operation, ram air enters the air conditioning compartment plenum chamber through two ram air intakes, located on the lower surface of the "880" fuselage, near the leading edge of the wing. Ram air is introduced into two turbine-driven cabin superchargers which operate by bleed air from the main bleed air duct manifold in the ram air plenum compartment. The compressed ram air from the supercharger is then routed through a supercharger flow-control sensor and into an air-to-air heat exchanger,

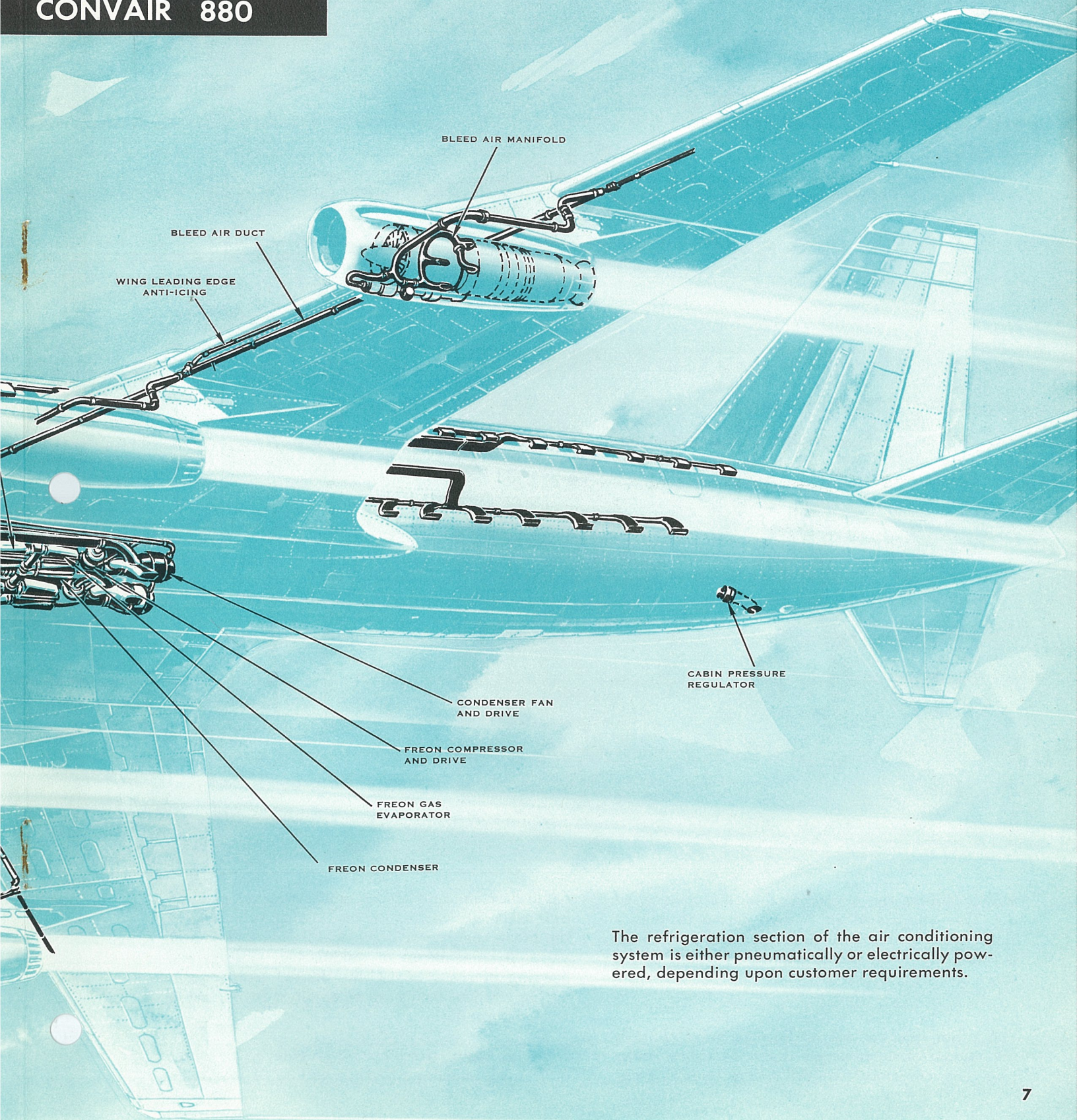
Schematic of cabin pressurization system and sectional views of cabin pressure regulator outflow valve and cabin pressure regulator outflow control and indicator.



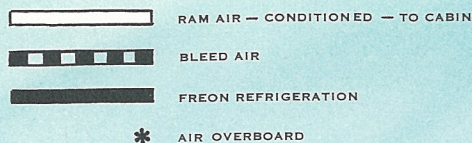
AIR CONDITIONING and PRESSURIZATION SYSTEM for the



CONVAIR 880



The refrigeration section of the air conditioning system is either pneumatically or electrically powered, depending upon customer requirements.



The basic air conditioning system is composed of two separate and independent subsystems, pneumatically-driven by bleed air from the four CJ-805 engines.

ENGINE BLEED AIR
REGULATOR AND
SHUTOFF VALVE

ENGINE

GROUND AIR CONDITIONING
CONNECTION

PILOTS' INDIVIDUAL
AIR VENTS

TO FLIGHT DECK

BLEED AIR
EMERGENCY
WING ISOLATION VALVE

SUPERCHARGER &
TURBINE DRIVE

RAM AIR

CABIN HEAT CONTROL
MODULATING VALVE

SUPERCHARGER
FLOW CONTROL SENSOR

RAM AIR

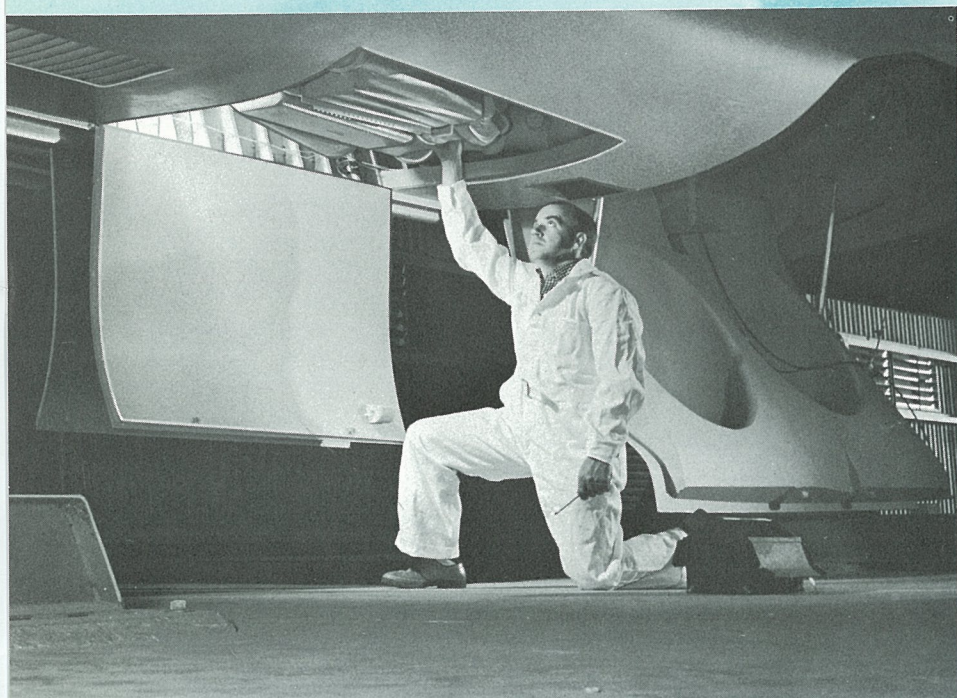
PLENUM CHAMBER

FREON GAS
EVAPORATOR

HEAT EXCHANGER

CONDENSER FAN
AND DRIVE

FREON COMPRESSOR
AND DRIVE



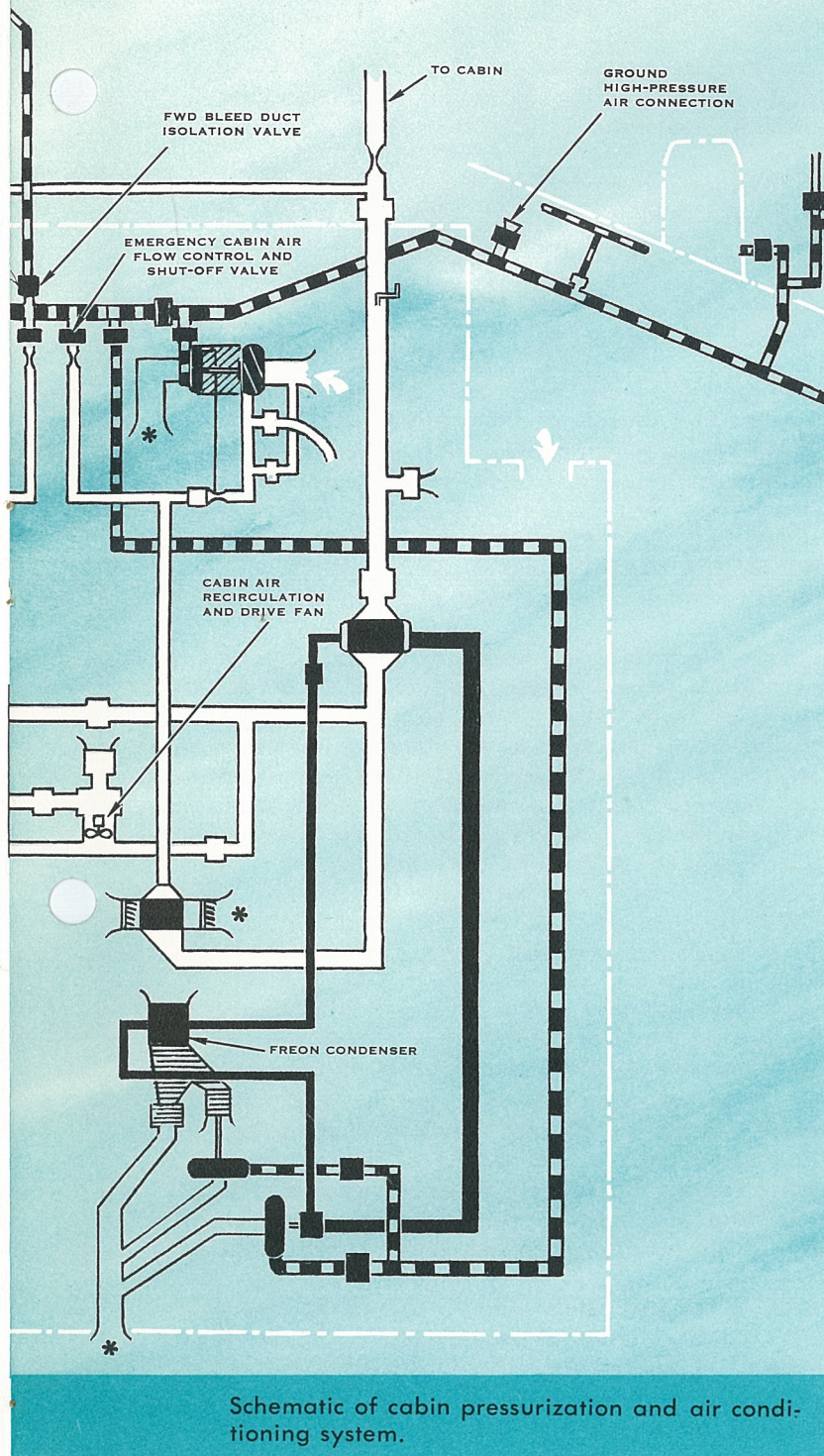
The entire Freon system is packaged so that it may be removed for servicing.

which reduces the temperature of the compressed air. This compressed air is then ducted through a Freon gas evaporator which further reduces the temperature of the air to the required demands of the cabin and flight deck.

A cabin heat control modulating valve controls the amount of supercharger discharge air recirculation. The temperature control system initiates a sig-

nal to the cabin heat control modulating valve, to the heat exchanger cooling air modulating valve, and to the Freon compressor drive modulating and shutoff valve. By a sequence of modulating, closing, and opening of these valves, any desired temperatures within required limits can be obtained for the cabin and/or flight deck.

Engine compressor bleed air provides an air source of 237 psig maximum pressure and 867°F maximum



Schematic of cabin pressurization and air conditioning system.

temperature. The engine bleed air pressure regulator "tops off" bleed air pressure to a maximum of 50 psig and acts as a check valve to allow engine starting. The regulator also provides a means for shutting off bleed air at the source.

Bleed air, manifolded from each engine bleed air port through a bleed air pressure regulator, is ducted into the bleed air manifold duct in the wing leading edge between the forward spar and a fiberglass anti-

icing discharge air baffle. This space is purged with ram air in flight. The ram air flow serves to remove the heat dissipated from the bleed air lines and insures that a maximum temperature of 200°F is not exceeded in that area.

After the compressed ram air from the superchargers is cooled through the Freon evaporators, it is carried in respective lines to the cabin and flight deck through respective flow limiters. A manifold duct connects the cabin and flight deck lines together, upstream of the flow limiters. This manifold duct allows the excess air flow, above the needs of the flight deck, to divert to the cabin line. The conditioned air to the flight deck is distributed to the pilot, copilot, and flight engineer through a system of individual adjustable outlets, resembling piccolo tubes, and a compartment inlet. The conditioned air to the cabin is distributed to the passengers through openings below the hatches on each side of the cabin, above alternate cabin windows. Individually-adjusted outlets are provided in the hat rack panels and in the buffet and each lavatory.

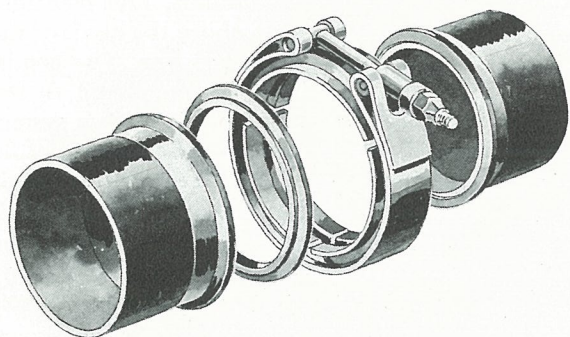
During steady-state operation, a thermostatic expansion valve allows Freon liquid to enter the evaporator at a rate which insures complete vaporization of the liquid before it leaves the evaporator. The vaporized Freon is then ducted to the compressor which increases the pressure and temperature of the gas. The compressed gas is directed to the condenser where the heat is removed by cool ram air flow. The cooling action condenses the Freon gas back to the liquid. The liquid Freon leaves the condenser, according to the demands of the thermostatic expansion valve, thus completing the cycle.

An alternate source of ram air is provided for an unpressurized flight condition in the event both superchargers or both Freon systems fail. During unpressurized flight at 250 knots IAS and 8000 feet altitude, the ram air flow to the cabin and flight deck will not be less than 140 pounds per minute. No heat is supplied during this operation.

In the event both superchargers should fail at an altitude necessitating pressurization, the bleed air emergency system will be used. Bleed air for the system is taken from two places in the main bleed air duct, located in the ram air plenum compartment. One bleed air line connects into the flight deck supercharger outlet and the other line connects into the cabin supercharger outlet. A flow-control and shutoff valve is provided in each bleed air line. A check valve is provided in each supercharger outlet line upstream of the bleed air line connection into the supercharger outlet. This prevents the bleed air from flowing out of the superchargers if emergency bleed air pressurization is required.

To accommodate wing bending and thermal expansion in the wing leading edge bleed air manifold line, a compression bellows system is used.

Marman type LJ-11 duct joint couplings are utilized throughout the bleed air system. A special safety strap is also provided over the coupling "T" bolt. Because the safety strap cannot be latched until the proper torque has been applied to the "T" bolt nut, this strap presents a positive visual inspection point for each joint.



Quick-Disconnect duct joint couplings are used throughout the bleed air system.

The complete bleed air system is covered with a 1/2-inch thick fluid-tight insulation, fabricated from fibreglas batting, and two layers of resin-impregnated fibreglas cloth. The bleed air duct joints also have a resin impregnated cover. The covers are split to allow installation and ready inspection of the bleed air joints. The ends of the covers are clamped to the duct insulation, providing a fluid-tight seal.

The following indicators and controls for the cabin and flight deck superchargers are located on the flight engineer's control panel: overspeed trip warning light, rpm indicator, bearing temperature indicator, air flow indicator, and ON-OFF control switch.

Also on the flight engineer's panel are indicators and controls for the cabin and flight deck Freon systems: Failure warning light, ON-OFF control switches, and ON-CABIN-OFF-FLIGHT DECK OFF control switches.

The following controls and indicators are utilized for cabin pressurization on the flight engineer's control panel: barometric pressure correction control knob, cabin pressure rate-of-change control knob, cabin altitude selector knob, cabin low-altitude warning horn, cabin rate-of-climb indicator, cabin altimeter, cabin differential pressure indicator, a four-position AUTO-OFF-CLOSE-OPEN switch for each pressure regulator (the CLOSE and OPEN positions

are momentary positions only), and FWD FAIL and AFT FAIL indicator lights for each respective pressure regulator.

Switches are provided on the overhead panel in the flight deck for individual ON-OFF control of each engine bleed air pressure regulator. Adjacent to each switch is a malfunction light which indicates closure of the pressure regulator valve when it should be open and modulating.

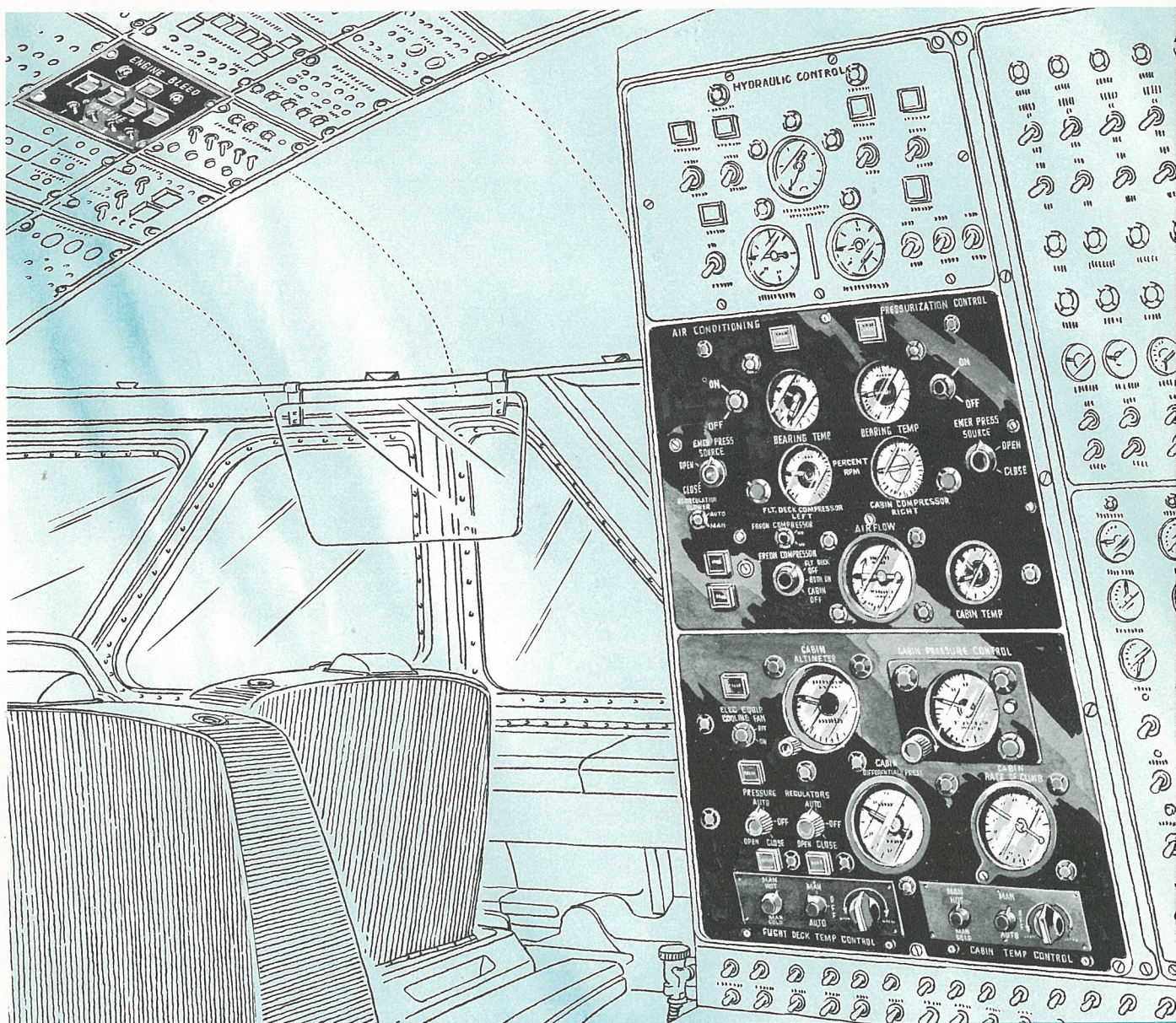
Both the cabin and flight deck have the following temperature controls: a three-position AUTO-OFF-MAN switch which provides for manual or automatic operation of the temperature control system, a two position MAN HOT — MAN COLD momentary switch for manual operation, and an INCREASE — DECREASE variable control for completely automatic operation of each temperature control system.

Five additional switches are provided for the pneumatic-drive Freon system, and three additional switches are provided for the electric-drive Freon system. All of these switches are three-way units with AUTO-OFF-MAN-ON positions and adjacent excess-heat indicator lights. The switches are used for isolation control of applicable sections of the bleed air duct system in the event of a malfunction.

For example: if a failure occurs in the left wing bleed air duct, a continuous wire overheat detector automatically closes the bleed air pressure regulator valves on the No. 1 and No. 2 engines, and closes the wing emergency isolation valve on the left side. At the same time, the excess-heat indicator light next to the respective wing isolation switch lights. The valves remain "closed" and the light remains "on" until the switch is moved to the OFF position. With the switch in the OFF position, the valves are still closed but the light is out. The valves may be reopened by turning the switch to the ON position.

If an overheat condition still exists, the excess-heat indicator light will go on again, but the valves will not close until the switch is manually returned to the OFF position. The temperature in the space adjacent to the bleed air ducts can be checked for abnormal conditions by a temperature indicator and rotary selector switch connected to individual space temperature pickups at several locations in each wing, and in the fuselage plenum chamber.

An extensive test program, consisting of a functional check of the complete "880" air conditioning system, has been underway for several months. Tests have been performed by simulating operation of the air conditioning system in the cabin, flight deck, and baggage compartments, to determine system compliance with Convair 880 design specifications.



Engine bleed control panel and flight engineer's cabin pressurization and air conditioning control panel are conveniently located on flight deck.

Tests to insure a balanced air flow were conducted in the full-scale mockup of the complete airplane. Air distribution ducts were installed and calibrated to give optimum performance under all anticipated conditions of normal operation, using various instruments to determine air velocities, noise levels, and temperature gradients.

Air conditioning tests were also performed in a full-scale cabin constant section of the Convair 880. The section was 19 feet long and completely equipped with upholstery, carpeting, seats, hat racks, and insulating materials. The entire section was sealed and placed in an environmental test chamber to simulate

actual temperature conditions as they would occur at an airport on a very hot day or at altitudes up to 40,000 feet. Temperatures in the test chamber were varied from -65°F to $+160^{\circ}\text{F}$.

Structural endurance tests were run to determine bleed air duct reliability. Stainless steel duct specimens from the wing leading edge were subjected to a pressure-cycling test at 800°F , and a 20,000-cycle bending test. The bending of the duct simulated the maximum wing flexure encountered during flight conditions. Further testing involved high-mach air flow through the duct at various temperatures up to 700°F .



CONVAIR

Traveler

VOLUME IX

NUMBER 10

MARCH 1958



CONVAIR *Traveler*

VOLUME IX NUMBER 10 MARCH 1958

Manager, Customer Service
J. J. Alkazin

Chief, Transport Service
L. J. Bordelon

Chief, Service Parts
J. Doig

Chief, Service Operations
J. V. Dickson

Chief, Service Publications
H. R. Kennedy

Editor
G. S. Hunter

Writer
Van Hedges

Art Editor
N. J. Rutherford

FOREWORD

Whether it's a request for a special Straylor-type rivet or an entire wing, Convair will fill the order for the new "880" jet transport through the Service Parts Section of its Customer Service Department.

The establishment of a new system for parts provisioning and procurement documentation, based on Integrated Data Processing, is designed to conform to the specific demands of jet age flight.

In effect, this system will streamline the Convair 880 service parts program to facilitate identification, selection, and procurement.

The manner in which this modern method for provisioning and documentation works, and the benefits which will be derived from its use, are described in this month's issue.

ON THE COVER

From customer request to delivered item, Service Parts Section people, pictured in Artist Dick Henderson's cover, are ready to provide prompt, efficient service to Convair 880 operators in the jet era ahead.

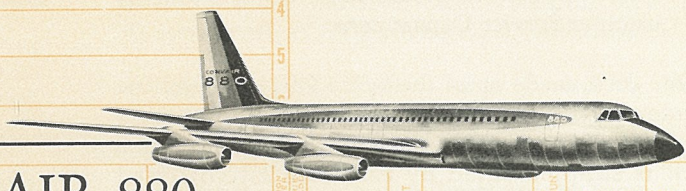


Copyright 1958

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of operation and service published monthly by the Service Publications Section of Convair Customer Service Department in the interest of Convair operators. Communications should be addressed to the Manager of Customer Service Department, Convair, San Diego 12, California.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without specific approval of their cognizant organization.

TRANS CODE	SUPPLIER CODE	EFFECTIVE DATE	CO. A/C SYS.	RESERVED	PART NUMBER	KEYWORD	R PC	MFR CODE	UNIT	UNIT PRICE	DISC	MIN QTY	STD PKG	SYD	LEAD TIME
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80
REMARKS															
															
for the CONVAIR 880															
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80

A newly developed system of parts provisioning and procurement documentation is announced by the Convair Customer Service Department. The system is devised to promote efficient identification, selection, and procurement of spare parts by operators of the Convair 880 commercial jet transport. Embodying simplicity, expediency, and reliability, the plan will provide "880" operators with maximum support in the maintenance of their aircraft.

The Service Parts Section of the Customer Service Department recognizes the fact that a grounded airplane is an economic burden to an operator. Hence, spares coordinators, production planners, parts controllers, and spares engineers know that it is their responsibility to keep an airplane flying, or to return it to flight operation as quickly as possible in the event that an incident has grounded it.

In planning ahead for the systematic replacement of parts, these spares people must be aware of what parts may wear out and when, and what parts are vulnerable to damage. In addition to the normal replacement function of spares procurement, such procurement also has an emergency category for parts that are not stocked by the customer and must be supplied as quickly as possible.

All of the thousands of replacement parts which will extend the operational life of the "880" fall under four main classifications: 1) insurance items, 2) maintenance items, 3) high usage items, and 4) accident items.

Insurance items are parts which are not subject to frequent replacement but which are vulnerable to possible damage, such as wing tips, stabilizers, and fins. Spares on these should be stocked as insurance in case of damage.

Maintenance items are parts which lose their full operating potential after continued use, but can be overhauled. Spares are kept on hand for utilization during the overhaul period.

High usage items are those parts with a limited life-span, and which are expected to wear out from normal attrition.

Accident items or sensitive parts, which are especially vulnerable in case of accident, are similar to insurance items, and are stocked as emergency replacements.

The basic fundamentals of logistics will be followed in getting these spare parts to "880" operators — to deliver the requested material to the right place at the right time. Thus, the Convair 880's 120-foot wing span and its four powerful CJ-805 turbo-jet engines will not be the only features that keep it aloft... the Convair Service Parts Section will assume the job of seeing that the airplane stays in the air — safely, efficiently, and economically — by utilizing the company's new system for parts provisioning and procurement documentation.

All elements of the Convair system have been developed in full accord with industry-wide specifications for Integrated Data Processing (IDP) systems, established by the Air Transport Association. The system conforms to three basic criteria: 1) all required information for each procurement function must be presented in mechanically reproducible form, 2) all forms must comply with Air Transport Association specifications, and 3) all documents must be suitable for both manual and machine handling. Precise control is maintained over "880" parts orders by means of established codes used on all card documents.

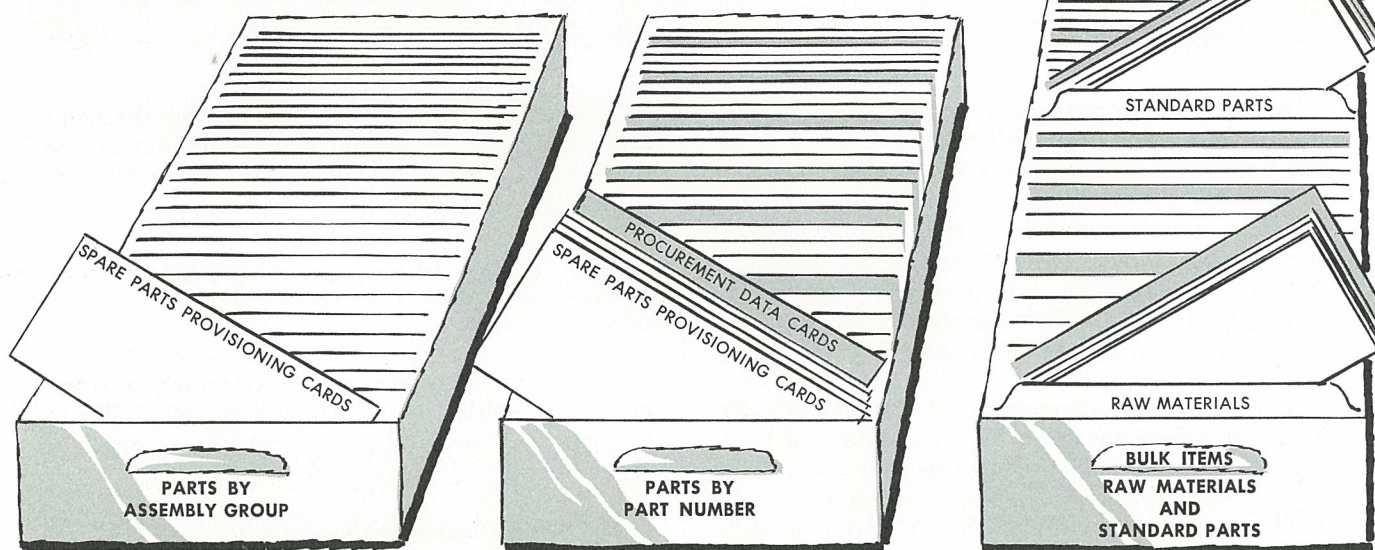
PROVISIONING DECKS



Identification, selection, and procurement of parts for the Convair 880 are initiated with the aid of three specialized sets, or decks, of IBM-adapted card forms. To establish and maintain the system, the following supplies are presented to the operator by the Customer Service Department:

Every component of the Convair 880, whether available from Convair, from an independent vendor, or from bulk stock maintained by the operator, is represented by one of the cards contained in the three provisioning decks.

One deck, made up of the Spare Parts List and the Vendor Parts List, contains Spare Parts Provisioning Cards filed in assembly-breakdown sequence; this deck is supplemented by card-size microfilmed drawings.

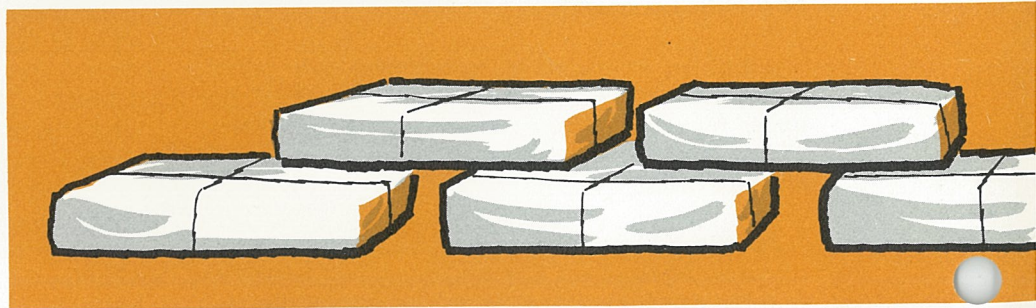


One deck, constituting a Spare Parts List Index, contains duplicate Spare Parts Provisioning Cards and Procurement Data Cards filed in part-number sequence.

A third deck, comprising the Bulk Items List, segregates "Raw Materials" from "Standard Parts."

Sufficient quantities of blank cards to ensure uninterrupted operation of the system are also furnished.

In the new system, the *Vendor Parts List* is integrated with the *Airframe Spare Parts List* and the decks are in duplicate. In one deck, cards are filed according to their respective aircraft assembly groups; in the other, according to part-number sequence. All cards are filed in their proper positions within the "Assembly Group" and "Part Number" provisioning decks. Either list, nevertheless, may be extracted by means of the IBM sorter.



Supply of Blank Cards



MICROFILMED ENGINEERING DRAWINGS *

Positive graphic identification of all "880" components is obtained from a complete set of coded engineering drawings supplied in the form of microfilm transparencies.

Individual transparencies are IBM card size. Each card is identified, or coded, to match the proper Spare Parts Provisioning Cards in the "Assembly Group" deck. The transparencies may be used in different types of available equipment for rapid scanning, extended viewing (such as wall projections), or used to produce enlarged paper workprints in a matter of seconds from a simply operated viewer-enlarger-printer.

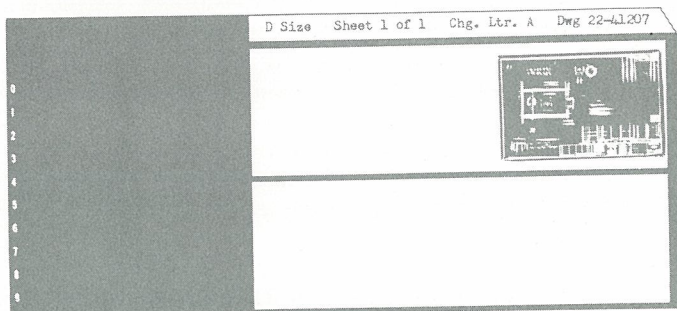
Whenever engineering drawing prints are required for reference purposes, they may be obtained quickly from the transparencies. The quality of detail reproduced on the microfilm, and the unusually durable finish of the special transparent foil, permit satisfactory enlargement and printing of the drawings, even after long usage.

Numerous types of viewers and printers are available. Machines range from small portable table models to large console models, which serve as combination viewers, enlargers, and rapid printers.

The three basic elements of the microfilm card are:
1) an identifying or code line, placed for best visual

reference when manually sorting; 2) the reduced image of the engineering drawing; and 3) supplemental drawing documents such as EO's.

The left portion of the transparency has been left blank for later inclusion of key-punched information. Proper digit spaces have been reserved specifically for assembly-breakdown sequence numbers and for original engineering drawing numbers and other drawing information. The first two digits of the sequence number will be the same as the aircraft system code number established by ATA Specification 100.



The Microfilmed Engineering Drawing

Original engineering drawings up to 42 inches in width and 12 feet in length are photographed in their entirety so that the reduced image appears unbroken by frames. This reproduces the drawing in the same continuous image form as the original drawing itself but on a reduced scale. This microfilmed image is then transferred onto a card-size piece of durable, transparent foil by direct contact. Less costly and much faster than photographic methods used previously, the card-size transparency is a perfect supplement to the new IDP system as applied to parts provisioning and procurement documentation for the Convair 880.

THE PROCUREMENT FUNCTION

Transition from the identification and selection functions to the procurement function is accomplished with Procurement Data Cards... the fundamental documents of the Convair Integrated Data Processing (IDP) system.

Procurement Data Cards, representing all "880" recommended spare parts, are filed in the "Part Number" and "Bulk Items" provisioning decks. Each card contains constant information for Order Card preparation.

To ensure continuous reliability throughout initial provisioning and subsequent reordering, Convair provides the operator with revised cards reflecting all changes in "880" systems and components.

* KEY-PUNCHING AND MACHINE SORTING OF MICROFILM FORMS IS UNDER DEVELOPMENT.

Yellow Procurement Data Cards with complete information, in both punched and printed form, are provided for all "880" recommended spare parts. Cards selected for particular transactions are withdrawn from the decks and sent to the IBM operator for duplication. One set is returned to the deck, the other is used by the operator's ordering personnel for preparation of Order Cards.

TRANS CODE	SUPPLIER CODE	EFFECTIVE DATE	RESERVED	PART NUMBER	KEYWORD	UNIT PRICE	DISC	MIN QTY	STAN. PKG	LEAD TIME
1 1 1	1 1 1	1 1 1								
2 2 2	2 2 2	2 2 2								
3 3 3	3 3 3	3 3 3								
4 4 4	4 4 4	4 4 4								
5 5 5	5 5 5	5 5 5								
6 6 6	6 6 6	6 6 6								
7 7 7	7 7 7	7 7 7								
8 8 8	8 8 8	8 8 8								
9 9 9	9 9 9	9 9 9								

The Yellow-Colored and the Red-Colored Procurement Data Cards

Red Procurement Data Cards are positioned throughout the "Part Number" and "Bulk Items" decks with reference to all "880" parts for which quantity-price breaks have been established. Inserted immediately behind their respective yellow Procurement Data Cards, the red cards are identical in data content with the yellow cards, except for indicated prices. One or more red cards may accompany any yellow card, depending on the number of quantity-price breaks applicable. Handling of the red Procurement Data Cards within the system is precisely the same as that accorded the yellow cards.

Blue-colored Procurement Data Reference Cards are issued simultaneously with new yellow and red Procurement Data cards whenever "880" part numbers are replaced with new part numbers, following engineering changes. These Reference Cards provide a record of old part numbers, new part numbers, and reasons for changes.

Data content of the Procurement Data Card is as follows:

- TRANSACTION CODE** — Indicates intended usage of card.
- SUPPLIER CODE** — Identifies supplier (Convair).
- EFFECTIVE DATE** — Effective date of card information.
- RESERVED** — Column reserved for future use.
- COUNTRY OF ORIGIN** — Country where part is manufactured.

TRANS CODE	SUPPLIER CODE	EFFECTIVE DATE	RESERVED	OLD PART NUMBER	KEYWORD	NEW PART NUMBER	REASON
1 1 1	1 1 1	1 1 1					
2 2 2	2 2 2	2 2 2					
3 3 3	3 3 3	3 3 3					
4 4 4	4 4 4	4 4 4					
5 5 5	5 5 5	5 5 5					
6 6 6	6 6 6	6 6 6					
7 7 7	7 7 7	7 7 7					
8 8 8	8 8 8	8 8 8					
9 9 9	9 9 9	9 9 9					

The Blue-Colored Procurement Data Reference Card

AIRCRAFT SYSTEM CODE — Identifies applicable aircraft system (ATA Specification 100).

PART NUMBER — Manufacturer's part number.

KEYWORD — Abbreviated part description (Mil. Std. 12A).

REVISION NUMBER — Number of revision following basic issue.

PROPRIETARY CODE — Indicates whether coded supplier is sole source of supply.

MANUFACTURER CODE — Identifies manufacturer whose part number is used.

UNIT — Ea., Ft., Lb., etc.

UNIT PRICE — Supplier's price per unit.

DISCOUNT — Percentage of discount available to the customer.

MINIMUM QUANTITY PRICE BREAK — Minimum quantity to which unit price is applicable.

STANDARD PACKAGE — Number of units contained in standard package.

LEAD TIME — Required lead time in days.

THE ORDER CARD

Manila Order Cards function as purchase orders (both normal and "expedited"). Order Cards may serve also to transmit quotations, changes, acknowledgments, exceptions, or numerous other directives between the operator and Convair.

In keeping with the concept of Integrated Data Processing, 60 per cent of the information recorded on the Order Cards is duplicated by machine reproduction from the Procurement Data Cards. The remainder of the ordering information (handwritten variable data) is key-punched into the Order Card.

Before transmittal to Convair, completed Order Cards containing all procurement information for

particular transactions may be used as masters for the automatic reproduction of various other forms required within the operator's internal accounting systems.

At Convair, data on the Order Cards received from the operator are automatically perpetuated on related cards in the system; thus, the possibilities of error are reduced and the advantages of rapid processing realized.

Acknowledgment of individual Order Cards is submitted to the Operator within 15 days.

Information appearing on the Order Card is as follows:

TRANSACTION CODE — Indicates intended usage of card.

SUPPLIER CODE — Identifies supplier (Convair).

CUSTOMER CODE — Identifies customer submitting card.

RESERVED — Reserved for future use.

COUNTRY OF ORIGIN — Country where part is manufactured.

BATCH NUMBER — Number assigned to Order Card batch. (Sequence restarted daily.)

ORDER NUMBER — Customer's Purchase Order or Quotation number.

PART NUMBER — Manufacturer's part number.

KEYWORD — Abbreviated part description (Mil. Std. 12A).

MODEL OR REVISION NUMBER — Aircraft model number on first issue or revision number on revised card.

PRICE BREAK CODE — Number of Order Cards to be consolidated for price break application.

QUANTITY ORDERED — Quantity of specific part ordered.

UNIT — Ea., Ft., Lb., etc.

UNIT PRICE — Supplier's price per unit.

DISCOUNT — Percentage of discount available to the customer.

"SHIP TO" CODE — Operator-designated shipping destination.

SPECIAL HANDLING — Specifies internal handling on receipt of parts at operator's facility.

SHIPMENT CONTROL — Coded shipment control instructions to supplier.

SPECIFIED SHIPPING DATE — Operator-specified shipping date.

SPECIFIED SHIPPING METHOD — Method of shipment and whether collect or prepaid.

THE CONTROL CARD

Green Control Cards are prepared by the operator to serve as transmittal control for all orders submitted to Convair. One Control Card is packaged with each "batch" of Order Cards.

As on all other cards used in the Procurement system, information entered on the Control Cards is both punched and printed. The various transactions that may be initiated with Order Cards are distinguished by means of the established industry-wide coding system.

In addition to serving as a source of practical order data, the completed Control Card acts as a legal document bearing the signature (also punched) of the operator's authorizing representative.

When orders are received at Convair, the contents are verified immediately according to the accompanying Control Cards. Duplicate Control Cards are completed with entry of receipt information, signed by the Convair receiving agent, and promptly returned to the operator.

Information contained on the Control Card is as follows:

TRANSACTION CODE — Indicates intended usage of card.

SUPPLIER CODE — Identifies supplier (Convair).

CUSTOMER CODE — Identifies customer submitting card.

RESERVED — Reserved for future use.

BATCH NUMBER — Number assigned to Order Card batch. (Sequence restarted daily.)

DO/DMS RATING — Defense Material System rating when applicable.

ORDER NUMBER										PART NUMBER										KEYWORD										QUANTITY ORDERED										UNIT PRICE										DISCOUNT										SHIPMENT CONTROL																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																													
TRANSACTION CODE										SUPPLIER CODE										CUSTOMER CODE										RESERVED										COUNTRY OF ORIGIN										BATCH NUMBER										ORDER NUMBER										PART NUMBER										KEYWORD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																									
QTY ORDERED										UNIT										UNIT PRICE										DISCOUNT										SHIPMENT CONTROL										SPECIFIED SHIPPING DATE										SPECIFIED SHIPPING METHOD										DO/DMS RATING																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
REMARKS										TRANSACTION CODE										SUPPLIER CODE										CUSTOMER CODE										RESERVED										COUNTRY OF ORIGIN										BATCH NUMBER										ORDER NUMBER										PART NUMBER										KEYWORD																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																															
222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222										333										444										555										666										777										888										999										000										111										222									

THE PROCUREMENT DATA PROCESSING SYSTEM

The benefits of Convair's new spare parts procurement system are illustrated in the following example, which shows a typical sequence of parts procurement activities embodying direct work flow, uniform paperwork, and the prompt filling of orders.

By examination of the microfilm transparencies and Spare Parts Provisioning Cards contained in the three provisioning decks, positive identification and selection of required spare parts are accomplished.

Yellow Procurement Data Cards, one for each spare part selected, are withdrawn from the decks and given to an IBM clerk for automatic reproduction of data on blank Manila Order Cards.

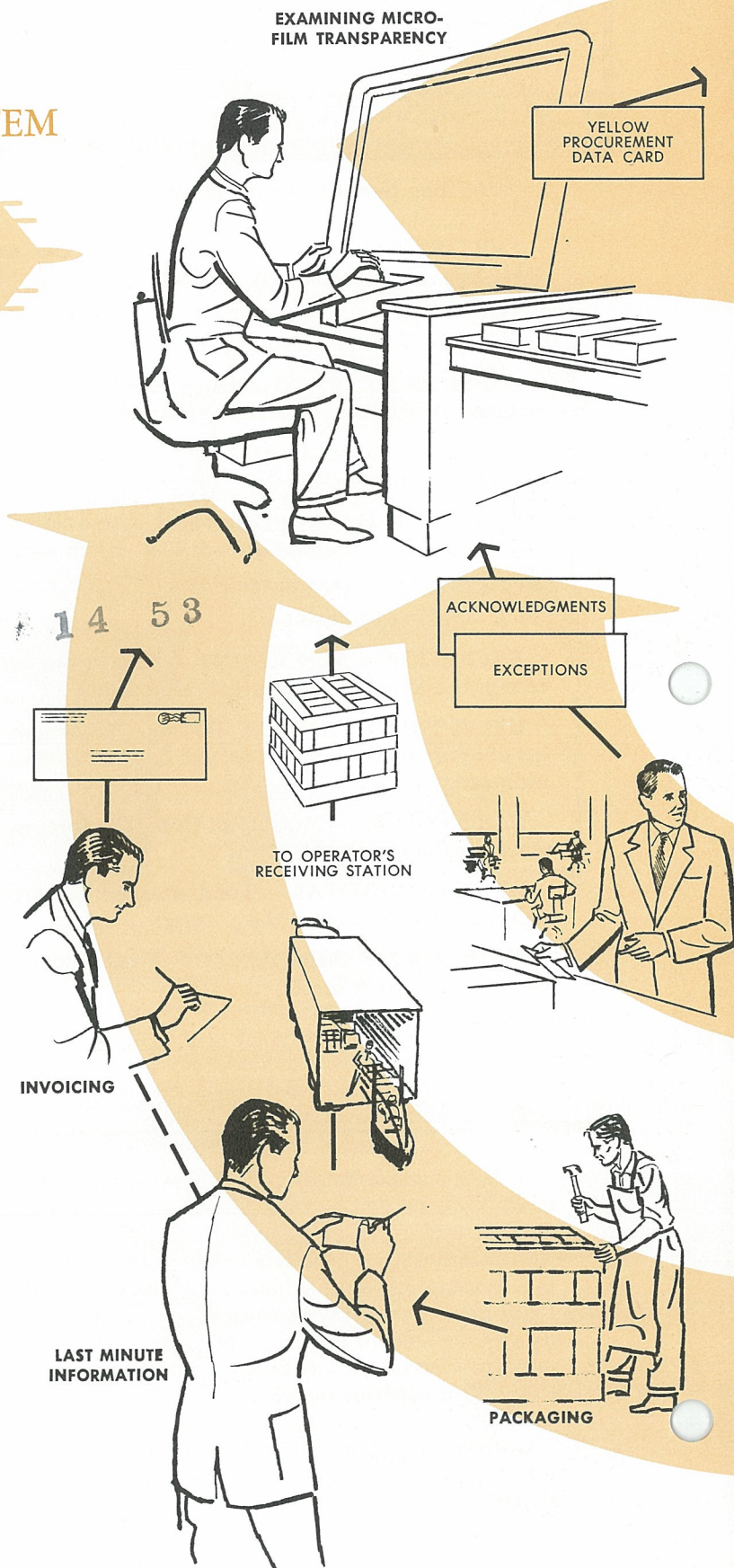
Additional information, such as shipping instructions, schedule, etc., related to individual procurement transactions, is handwritten on the Order Cards, which are then returned to the clerk for IBM completion.

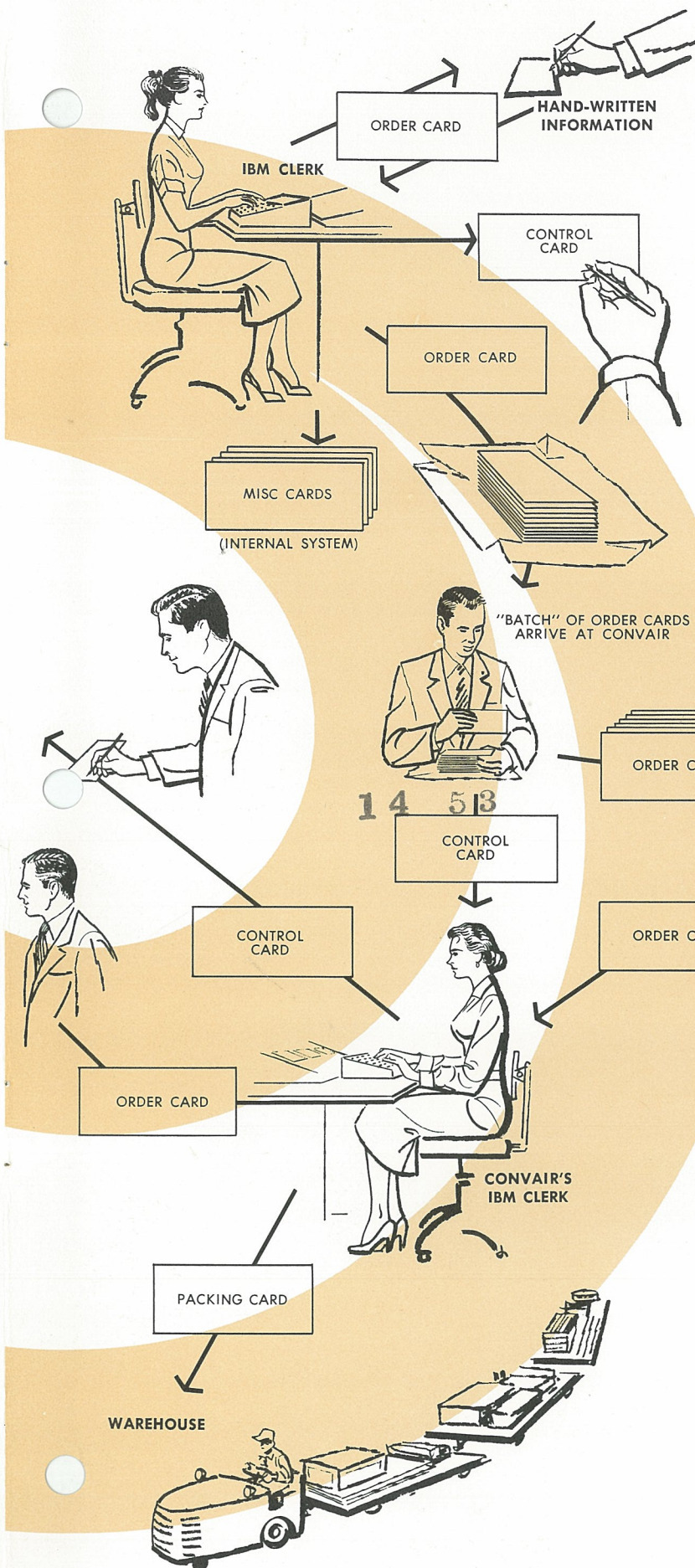
The IBM clerk key-punches the handwritten data into the Manila Order Cards, initiates one green Control Card for each "batch" of Order Cards (99 or less), and prepares any additional cards that may be required for use in the operator's internal systems.

Each completed Manila Order Card contains all information required by the Convair Customer Service Department to fill the operator's order for a specific part. For simplification of handling and control, Order Cards are accumulated in groups, or "batches" according to transaction codes.

Each green Control Card is an accounting of the Order Cards contained in one "batch." After being checked and signed by the operator's authorizing agent, the Control Card is packaged with its respective Order Cards and sent directly to Convair.

Cards for use in the operator's internal systems may comprise such documents as accounting controls, stores notifications, purchasing records, etc.





On arrival at Convair, each "batch" of Order Cards is checked against the accompanying Control Card.

A duplicate Control Card is then made, signed by the Convair receiving agent, and immediately returned to the operator to confirm receipt of the Order Card batch.

The information on each Manila Order Card is compared with information in Convair's master parts files. Should the information on any Order Card be superseded, the card is segregated for special handling.

Convair's IBM clerk prepares one salmon Packing Card and one Acknowledgment Card for each accepted Order Card, and an Exception Card for any Order Card requiring alteration.

Immediately following order entry procedures (within 15 days), Acknowledgment Cards are sent to

the operator. Exception Cards are sent within the same period.

Salmon Packing Cards are used throughout Convair's warehousing, packaging, and shipping facilities as a means of constant order identification.

Immediately before shipment of parts, last-minute shipping information is entered on each Packing Card by the Convair shipping agent. Packing Cards and parts are then sent to the operator's designated receiving station.

Customer invoices are prepared from Packing Card information and issued by the Convair Accounting Department.

In this manner, expedient and reliable product support is accomplished through Convair's Integrated Data Processing system.

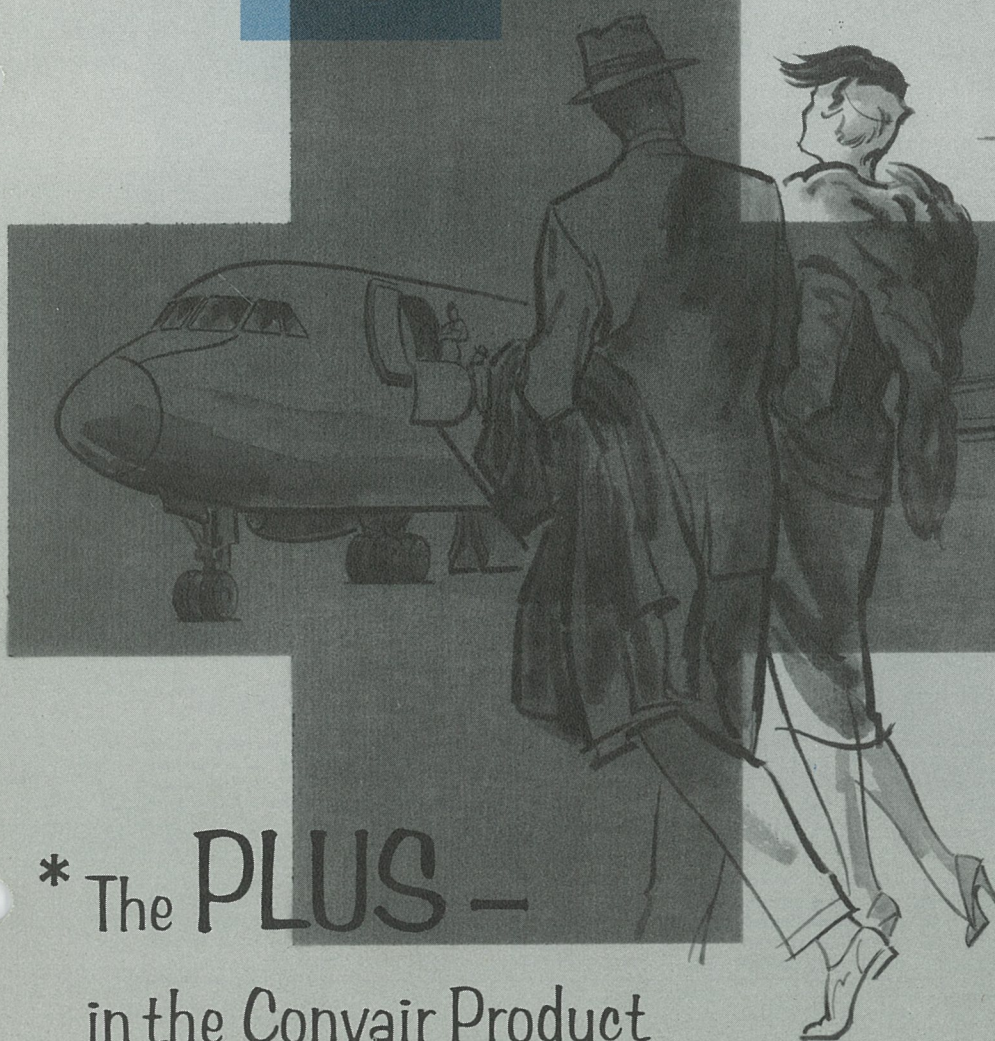
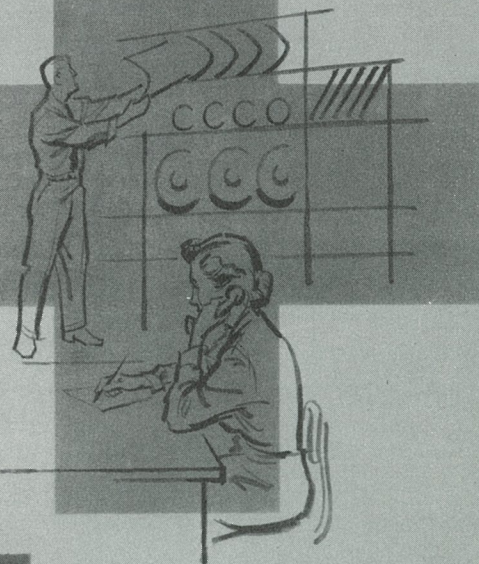
CONVAIR

Traveler

VOLUME IX

NUMBER 11

APRIL 1958



*The **PLUS** —
in the Convair Product

CONVAIR *Traveler*

VOLUME IX NUMBER 11 APRIL 1958

Manager, Customer Service
J. J. Alkazin

Chief, Transport Service
L. J. Bordelon

Chief, Service Parts
J. Doig

Chief, Service Operations
J. V. Dickson

Chief, Service Publications
H. R. Kennedy

Editor
G. S. Hunter

Writer
Van Hedges

Art Editor
N. J. Rutherford

FOREWORD

Almost any place in the world where commercial airlines operate, Convair transport aircraft are on the scene, giving dependable, economical service. The Convair operator family is a big one, and continues to grow as airlines place their orders for the new jet "880." Still other operators are purchasing resale Convair-Liners, whose long operational life certifies to their structural integrity.

But, past or present, original or supplementary owner, Convair is aware that proper service support from the manufacturer is the prerequisite for maintaining flight schedules and for keeping aircraft in top operating condition.

Like its Convair-Liner predecessors, the Convair 880 commercial jet transport has been designed to include the most versatile, dependable, and economical features the present air age can produce. What this means to commercial operators is high utilization, higher passenger acceptance, and lower operating costs . . . all factors which contribute to higher profit.

To assure fast, efficient, and individual service to each of its customers, old or new, Convair has centralized all of its support services into a new Customer Service Department, whose functions are discussed in this issue.

ON THE COVER

Artist Jack Davis symbolizes the customer support that begins from the time a Convair transport is ordered and continues throughout its operational lifetime.



Copyright 1958

C O N V A I R
A DIVISION OF GENERAL DYNAMICS CORPORATION
(SAN DIEGO)

A digest of operation and service published monthly by the Service Publications Section of Convair Customer Service Department in the interest of Convair operators. Communications should be addressed to the Manager of Customer Service Department, Convair, San Diego 12, California.

The information published in the Convair TRAVELER is to be considered accurate and authoritative as far as Convair approval is concerned. CAA approval, however, is not to be implied unless specifically noted. Recipients of this information are cautioned not to use it for incorporation on aircraft without specific approval of their cognizant organization.

CUSTOMER SERVICE *

* The PLUS in the Convair Product

Customer service is the manufacturer's way of guaranteeing the product he represents. Such service begins from the time an airplane is in the design stage, and it continues throughout its long operational life. In the case of a "resale" Convair-Liner, for example, Convair offers service that is a result of nearly 10 years experience, gained in operation throughout the world — over all types of terrain and in all kinds of weather. Convair welcomes all new customers of these aircraft, and stands ready to offer the many services provided by the Customer Service Department.

This new department was established in order to consolidate such formerly diversified functions as Service Engineering, Field Service, Maintenance Training, Service Operations, and Service Publications into a single operation, with direct responsibility to Convair-San Diego Division management. As a result of integrating these functions, customized service designed to fit the particular needs of individual operators will be realized. The objective is to keep every Convair-built airplane in maximum operational condition, with consequent economical benefits to all customers.

The support policy that backs up Convair-manufactured aircraft, whether new or resale, evolves from the following Customer Service Department categories.

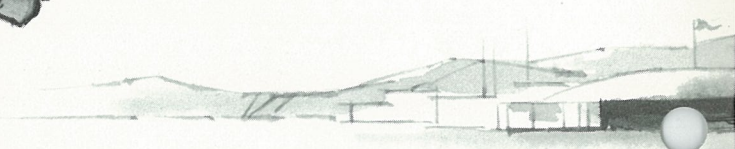


Transport Service Section

Service Engineering — The Transport Service Engineering Section of the Customer Service Department is responsible for providing service engineering support to operators of Convair transport aircraft. The function of the Service Engineer is to evaluate information received from Convair representatives in the field or from the customer, pertaining to the operational status of an operator's airplanes. He is instrumental in improving the product through the implementation of design refinement, adjustment, and improvement of operation and maintenance practices, when such action is deemed advisable.

With the case histories of Convair transports at hand, the Service Engineer refers to his records whenever one of a variety of questions arises concerning a specific airplane. These records supply the basis for determining the life of system units; they are used in the study of all aspects of service practices or of effectiveness of modifications; they may reflect the effect of maintenance procedures. Designers call on surveys of service histories to aid them in new design.

All reports or letters received from operators or Field Service Representatives are screened by experienced Service Engineers to detect trouble that can be corrected by design refinement, or by changes in operational or maintenance techniques. Every request, regardless of its nature, is marked for immediate action. As each one comes in, it is assigned to a Service Engineer, who is a specialist in his field. He makes a complete and thorough study of all phases of the problem.



Records are reviewed and evaluated, and every aspect of the problem is analyzed. This entails contacting design engineering groups, inspection, and/or the vendor, as well as Service Parts and Service Publications, depending on the pertinence of the problem to them. The resultant compilation of facts, both reviewed and current, becomes the basis of an early reply to the customer or Convair Field Service Representative. This experience is transmitted to other Convair operators via a Service Engineering Report or Service Newsletter so that they may be alerted to the problem and to a recommended remedy.

Nearly every inquiry received is unique, requiring the solution to a variety of problems by diverse means which seldom follow the same pattern. The expeditious and thorough treatment given each of the hundreds of letters received every week testifies to the coordination that exists between the Customer Service Department and other departments. The single objective is always the same . . . to give dependable, fast service to the customer.

The Service Engineer is sent into the field periodically to offer assistance and advice, and to familiarize himself both with the customer's problems and with those of the Field Service Representative. In this manner, his knowledge is augmented by current appraisals of operation, and his ability to handle future incidents is amplified.

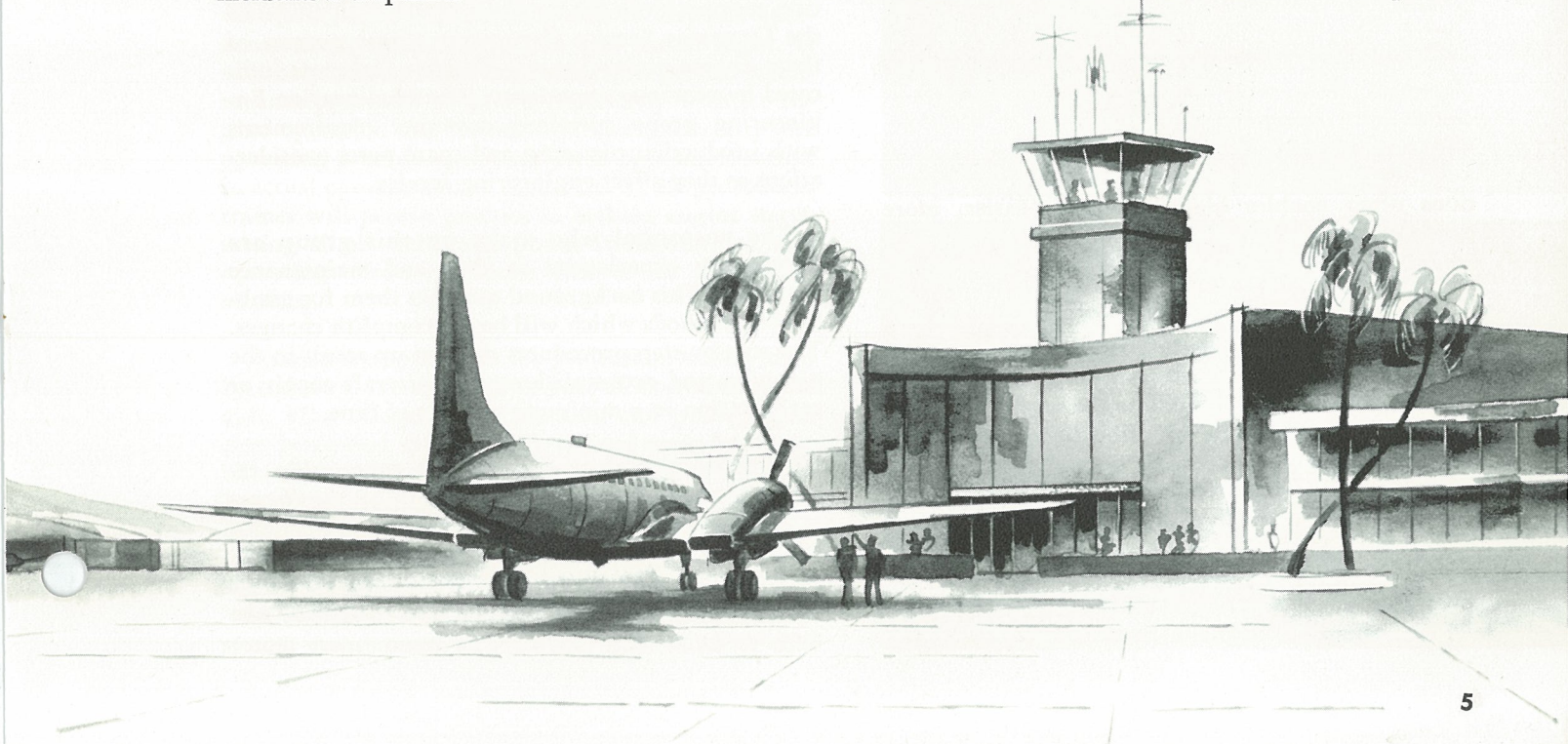
The Convair Transport Service Section retains approximately 25 Transport Service Engineers who serve as analysts and evaluators of matters affecting the company's product. Together with the Field Service Representatives, their goal is the constant improvement of flight safety, operation, maintenance, and serviceability of Convair transports.

Field Service Representatives — Convair's Transport Field Service Representatives are located at customer facilities in various areas of the world.

This representation is available to operators in such countries as Argentina, Australia, Belgium, Brazil, Canada, Costa Rica, Italy, Mexico, Norway, Pakistan, the Philippines, Poland, Saudi Arabia, Spain, Switzerland, Venezuela, and Yugoslavia, in addition to the United States.

On call 24 hours a day, each man is in the field primarily to recognize symptoms and to prescribe treatment for an airplane problem in order to prevent damage or further difficulty whenever possible. He is assisted by his file of technical material, including reports and replies to customer problems. In this way, he assists the operator by passing on experience and remedial action on a timely basis.

Prior to initial deliveries of a new airplane, these men in the field will have been assigned to customer installations where the new aircraft will operate.





There they will make pre-delivery preparations, and begin indoctrination of service and maintenance personnel well in advance of the actual arrival of the airplane.

Once an airplane has been delivered to an operator, it is the job of the Field Service Representative to review and analyze customer experiences, problems, suggestions, and recommendations pertaining to that airplane. He reports this information back to Convair, where it is used to improve the company product. The result is a heightened understanding and utilization of Convair aircraft already delivered, and improved efficiency and safety for aircraft scheduled for future production and delivery.

The Field Service Representative anticipates many problems before they are given an opportunity to develop. He is aware of the frequency cycles which govern the removal and inspection of airplane units or components. Those areas and units that are particularly subject to wear are catalogued for ready reference and consequent attention at the proper time. His cognizance of the problems likely to be encountered during the maintenance and overhaul operations often enables him to suggest easier, more expeditious ways of handling them.

However, these men know how to listen as well as to advise. Being in daily contact with operators and maintenance personnel in the field, Service Representatives give careful study to the suggestions and comments received. The adoption of many of their recommendations has contributed greatly to the top performance and maintenance of Convair aircraft in all sectors of the world.

The Field Service Representative provides on-the-job training whenever it is desired, or required. In this training, the airplane becomes his classroom.

With such life-size working units as landing gear, flight controls, systems, etc., personnel can become familiar with operation, adjustment, and checkout procedures for each airplane installation.

As a result of the recent integration of customer service functions, the responsibilities of Field Service Representatives will be increased to include procurement representation at operator facilities, thus enabling them to offer assistance in all areas of customer support. By serving as a communication line between Convair and the customer, they will be aware of customer requirements so that engineering or maintenance information and parts will be available on a customer-desired schedule.

Modification Engineering — The Convair Engineering Department supplies engineering modification support from the engineering design groups to the Customer Service Department. Assignments of these engineers involve modification design as indicated by customer experience. The Modification Engineering group correlates customer requirements with production planning and spare parts considerations as they affect engineering service.

The personnel who make up this group are thoroughly experienced in shop and maintenance functions. This background qualifies them for establishing methods which will best accomplish changes. The step-by-step procedures they set up result in the planning and accomplishment of aircraft repair or modification in a minimum amount of time.

Proposed changes are analyzed, thoroughly researched and, if feasible, interpolated into significant data for presentation to the customer. After a proposal has been completely reviewed and planned, Modification Engineering produces the drawings and engineering data necessary to complete the modification task.

Modification Engineering design data is forwarded to Aircraft Change Service, where the information is prepared in the form of Service Bulletins to cover kit installation.

Training — The Transport Service Engineering Section is also responsible for the dissemination of service improvement information, and the establishment of classes of instruction for customer maintenance personnel.

Presently, training for Convair 880 customers is provided in the form of a customer orientation course, tailored to fit the needs of airline staff level personnel. This program is designed to meet the information requirements of airline staff employees who have neither the time nor the need to acquire the technical knowledge presented in more formal training courses. This course is designed to fill the gap between individual conferences with top airline management and the detailed maintenance and operational training given to airline technical personnel.

Maintenance training is tailored to the customer's needs. Basically, the same types of training aids and programs that have been conducted in the past for Convair propeller-driven aircraft are scheduled for airline operators who will up-date their operational status with addition of the Convair 880 jet transport.

In the more formal training courses, a cockpit procedures trainer will be used for teaching "880" operation to Convair and customer flight and ground crews.

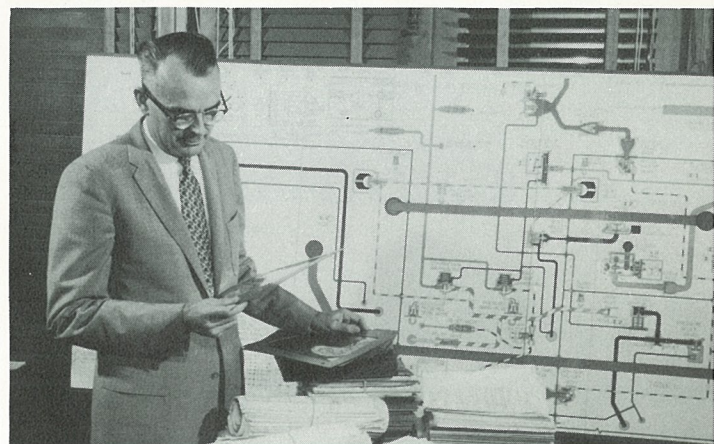
An accurate full-size replica of the "880" cockpit, the trainer will simulate all phases of airplane operation except radio navigation and actual flight. It will help pilots, flight engineers, and ground maintenance personnel to gain a familiarity with jet engine operation and normal and emergency airplane operating procedures not otherwise obtainable except in actual operation or in flight. Use of the procedures trainer will permit practice in making engine starts, setting climb and cruise power configurations, and operating aircraft systems just as in the actual airplane.

Framed transparencies for projection, widely used by industry, are included as part of Convair's visual aids. Flow diagrams, schematics, and photographs may be viewed in a normally lighted room by means of special projectors. Through the use of color overlays, black and white schematics may be employed to demonstrate flow under different operating conditions.

In addition to line drawings and photographs of system components and installations, units or dia-

grams may be sketched by an instructor with a grease pencil on a roll of transparent film, and then projected.

As with previous models of Convair aircraft, the "880" training program will be divided into two phases, either of which may be selected by the operator: 1) that which takes place at the San Diego plant, and 2) in-field training conducted by Field Service Representative instructors at the customer's own facility.



Service Parts

The Service Parts Section of the Customer Service Department is responsible for assisting the customer in the development of substantial spares support inventory by recommending items to be purchased, and by establishing and maintaining delivery schedules. Personnel of this section provide customer purchasing organizations with price schedules, accept customer purchase orders, and certify to the final delivery and billing for such spares.

In addition to performing their original spares support function upon delivery of an airplane, this group orders spares and kits to satisfy continuing customer operation, modification, and overhaul requirements.

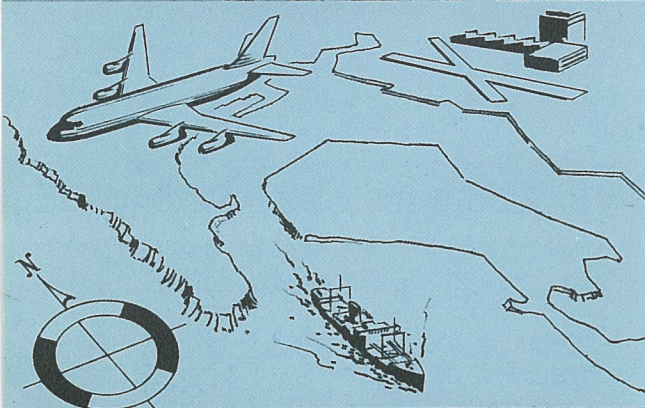
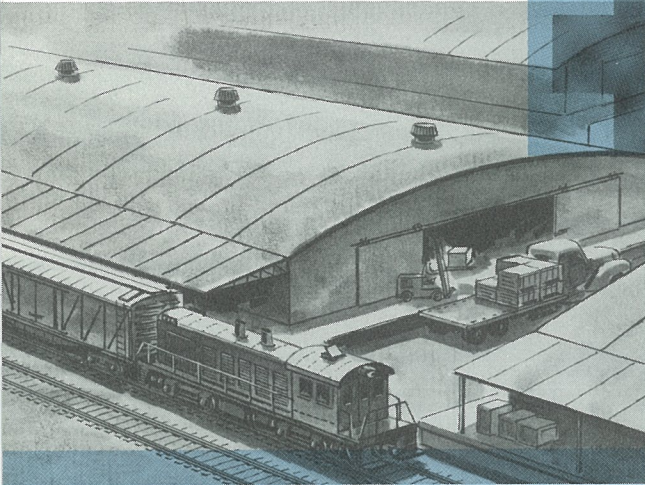
One of the newest and most practical functions of Service Parts is its Export Section, established to provide prompt and efficient processing of orders for overseas shipment.

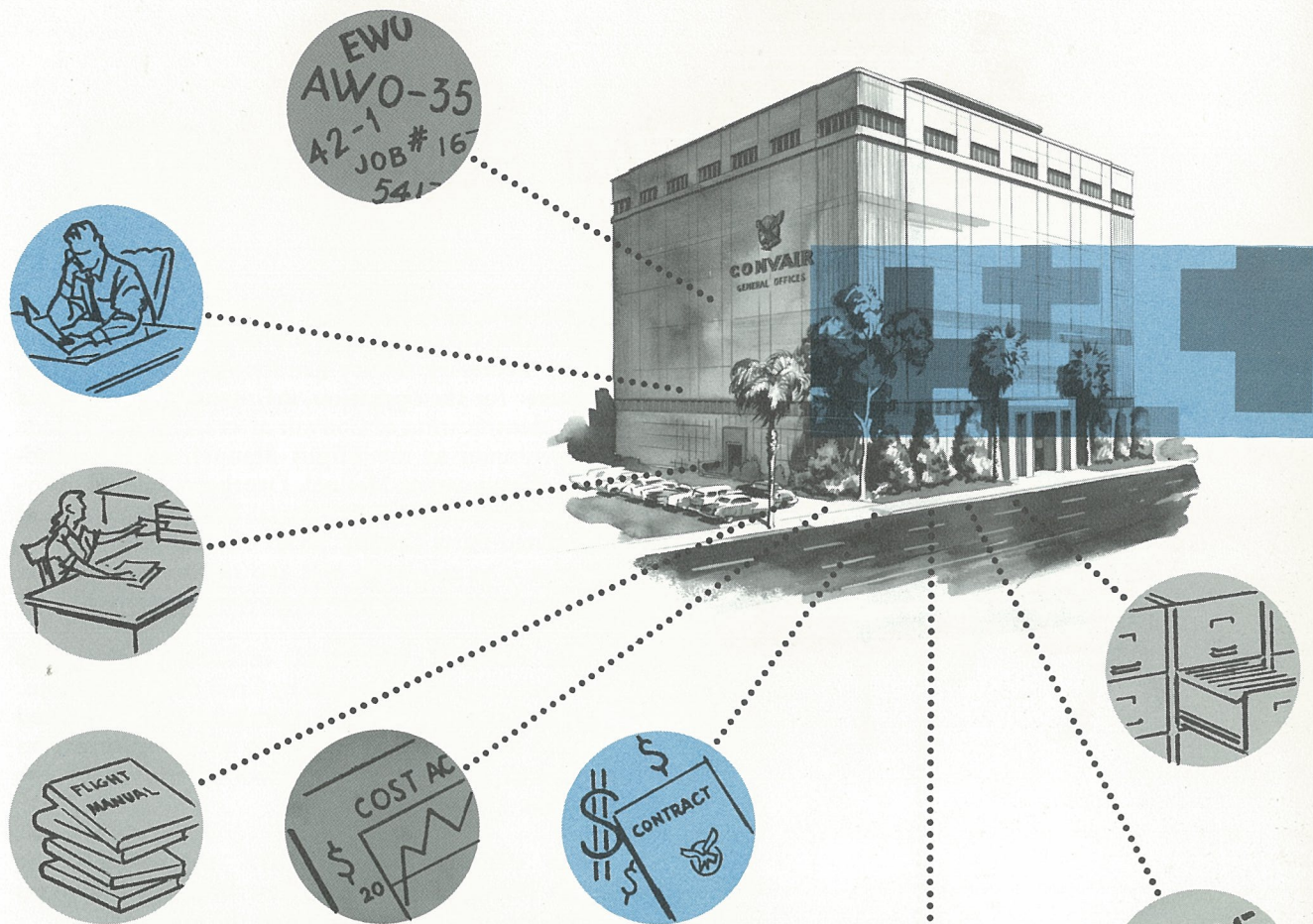
The Export Section will be equipped to arrange for inland, ocean, and air shipments to overseas ports of debarkation; insurance coverage; and clearance through U.S. Customs. It will obtain U.S. Department of State export licenses, and handle other documentation pertaining to the export of Convair spare parts.

This new factory-to-customer export service will minimize time in transit, and is offered at no direct cost to customers.

A streamlined system for parts provisioning and procurement documentation has been developed by the Customer Service Department, and offers a new approach to the identification, selection, and procurement of service parts for the Convair 880.

The system utilizes Integrated Data Processing, and is based on specifications established by the Air Transport Association. Fast, simple, and reliable, it permits exacting control over parts orders for the Convair 880 by means of IBM card documentation, using established codes. (For a detailed account of how this new system operates, see the March 1958 issue of the Traveler.)





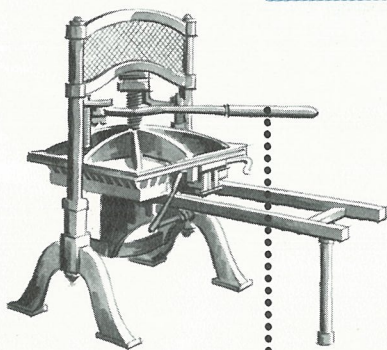
Service Operations

The Service Operations Section coordinates all administrative functions of the Customer Service Department, and is responsible for planning, scheduling, and budget control.

As the department's nerve center, it monitors accounting and engineering work orders; correlates all activities and reports; processes assignment orders to Field Service Representatives; distributes flight and maintenance manuals and other support publications; reviews budget proposals and maintains budget control; coordinates cost proposal outlines, as well as contracts; administers personnel matters; monitors the department's security performance; and maintains files of all subject matter pertinent to departmental activity.



Service Publications



Personnel of the Service Publications Section are responsible for compiling, preparing, and producing all the necessary service handbooks required by the customer for the operation, maintenance, repair, and parts identification of Convair aircraft. These include such volumes as the Flight Manual, Pilots' Handbook, Maintenance Manual, Overhaul Manual, Wiring Diagram Manual, Structural Repair Manual, and Illustrated Parts Catalog. In all of these publications, the aim is to minimize text and impart information visually by means of easy-to-follow illustrations.

The **FLIGHT MANUAL** includes performance and operating data required by Civil Air Regulations. It is a Civil Aeronautics Administration-approved manual, and supplies crews with all the information they need for safe and efficient operation of the airplane.

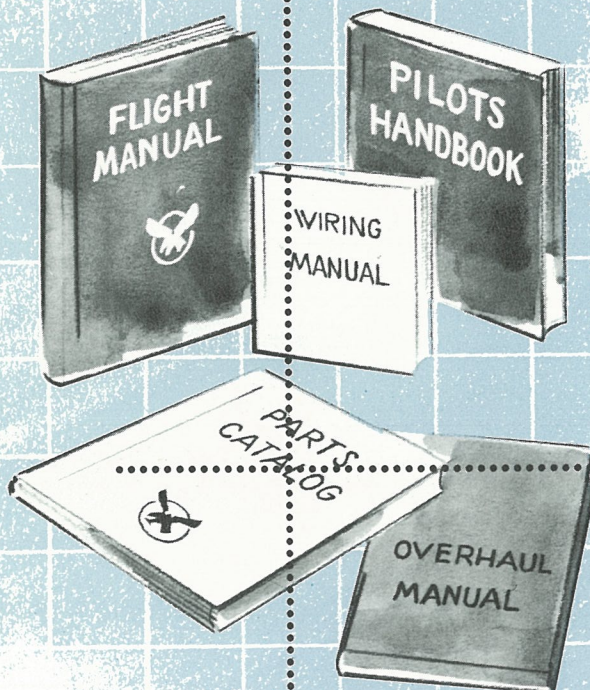
The **PILOTS' HANDBOOK** supplements the Flight Manual, and briefly describes and illustrates the major functional systems of the airplane.

The **MAINTENANCE MANUAL** contains the information and data required for complete flight-line maintenance of all installed systems and components of the airplane.

1 4 5 3

The **OVERHAUL MANUAL** contains brief descriptive information and detailed step-by-step instructions and data for all installed equipment and accessories which are subject to overhaul and on which work is normally performed away from the airplane, excluding structural repair.

The **WIRING DIAGRAM MANUAL** includes diagrams of all electrical and electronic wiring installed in the airplane. A separate Wiring Diagram Manual is prepared for each customer.



The STRUCTURAL REPAIR MANUAL is a CAA-approved manual, and contains information pertaining to the repair of secondary structure, and of such primary structure as is adaptable to field repair. Subsequent revisions describe actual structural repair experiences of operators.

The ILLUSTRATED PARTS CATALOG provides the operator with visual breakdown identification of parts for stock ordering. Vendor end items, both Convair-designed and vendor-designed, are included in the Parts Catalog, but are not broken down in detail.

A Training Study Guide is designed to augment the maintenance manual and contains information that is basic to aircraft in general, and to the "880" in particular. Information in this publication will have great practical value in rapidly orienting personnel participating in on-the-job training programs. Such a guide may serve as a personal study outline, and as material for use in basic theory courses. Experienced personnel may use the supplement as a guide for review, and the novice can utilize it as a basic text in many instances.

Other publications which help to support Convair transport operation include weekly and monthly field service periodicals, progress reports, and special booklets and brochures as required to describe specific phases of the airplane and its components.

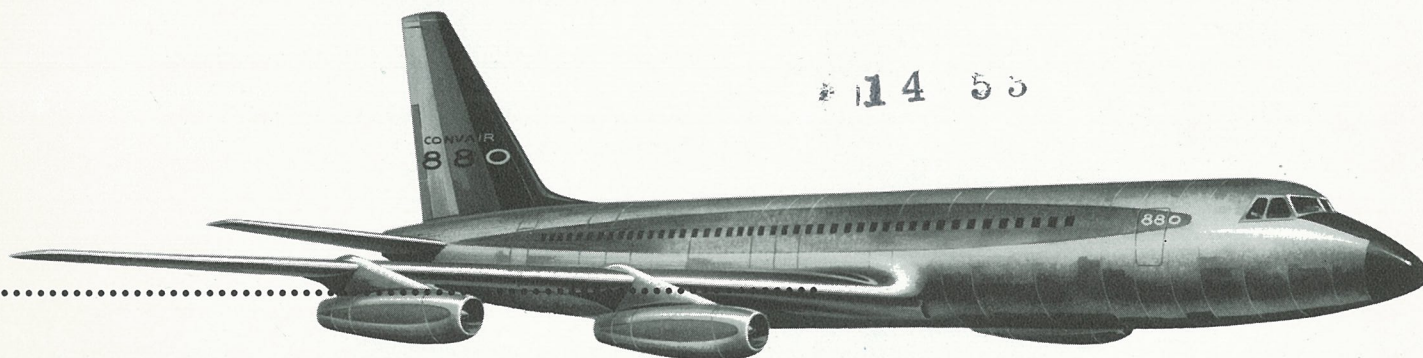
After delivery of its new commercial jet airliner, Convair will keep operators and Field Service Representatives up-to-date on all operational and maintenance phases of the "880" by means of a regularly-issued newsletter. Its contents will include Convair engineering information, reports of any service problems, and comments by operators and Service Representatives.

The Service Publications Section itself is broken down into four groups . . . Handbooks, Parts Catalog, Special Projects, and Illustrations.

(For a more complete description of the types of publications originated by the Service Publications Section, see the October 1957 issue of the Traveler.)

The foregoing services and the personnel who perform them are dedicated solely to the support of Convair transport customers. Similar services are provided the Air Force by a separate and distinct Interceptor Service Section.

Consolidation of these customer services early this year into one department ensures that every Convair transport operator will have a single, all-inclusive organization with which to deal after he has received his product . . . whether it is a new "880" or a resale Convair-Liner. Integration of these various segments of customer support means increased reliability, economy, and utilization for the customer in the operation and maintenance of the Convair aircraft he buys.



A 14 53

VOLUME IX — Nos. 1 to 11 Inclusive

INDEX – VOLUME IX – Nos. 1 to 11 Inclusive

